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The study establishes a university-wide space inventory system for the University of Guelph, Ontario which provides data about the utilization of available space. The inventory data establishes space requirements for instructional and related research needs, identifies amounts and location of space available for academic units needing interim space during early construction phases, and indicates rooms where investment in renovation produces highest utilization rate. The program procedure is--(1) inventory of all existing space on campus, (2) projection of instructional and related space needs to 1970, (3) evaluation of existing space utilization, (4) identification of projected teaching space needs, (5) criteria for upgrading present utilization, (6) recommendation for improvement of existing teaching stations, and (7) procedures for a continuing space management system. Each phase includes descriptions, definitions, procedures, data collection forms, and tables of collected data. The space inventory and management programs are designed for computer application. The appendices include the necessary information for a space inventory study, goals of the project, and facility recommendations. (HH)

SPACE UTILIZATION AND PROGRAMING

UNIVERSITY OF GUELPH
LONG RANGE DEVELOPMENT PLAN

PROJECT PLANNING ASSOCIATES LTD.
RICHARD P. DOBER
THOMAS R. MASON

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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SPACE UTILIZATION AND PROGRAMING

UNIVERSITY OF GUELPH
LONG RANGE DEVELOPMENT PLAN

ED022332

FEBRUARY, 1965

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RICHARD P. DOBER
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March 19th, 1965

Chairman and Members of the
Board of Governors,
University of Guelph,
Guelph, Ontario.

Gentlemen:

We are pleased to submit our final report on the utilization of instructional and related space at the University of Guelph. The attached document is a comprehensive coverage of both existing conditions and proposed improvements. It includes recommendations and standards for future utilization and outlines a set of procedures that will help the University meet its long-range development goals.

In order to realize these objectives, however, it is necessary that the University immediately implement the proposal by using it in the assignment of space in the next semester.

This Space Utilization Study is a result of the combined efforts of three organizational groups. Under the guidance of the director, Mr. Richard P. Dober, a project group was established managed by Mr. Robin Upton and comprising R. Modlich as statistician and B. Katterwe, and H. Fauber as assistants. Dr. Thomas R. Mason of the University of Rochester was technical consultant on space utilization and programming.

To the best of our knowledge this is the first time a Space Utilization Study at a Canadian University has been used as an implementation tool in the planning process. If carried on it will give further evidence of the University's intention to meet its obligation to create a University which is academically strong, aesthetically pleasing, and physically developed with economy and dispatch.

Yours very truly,

Macklin L. Hancock

Macklin L. Hancock,
for Project Planning Associates Limited and
Richard P. Dober, Consultants

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PUNCHED CARDS.

Box 1 and 5:	A cards. Complete inventory of rooms at University of Guelph, Fall, 1964.
Box 2 and 3:	C-1 cards. Scheduled instruction at University of Guelph projected to 1970.
Box 2:	Programme cards for I.B.M. 7044 computer. For preliminary computations.
Box 3:	C-2 cards and Summary cards. Scheduled instruction at University of Guelph, Fall Term 1964 and Summary of building and room data.
Box 4:	Programme cards for Burroughs 2200 computer for final tabulations.
Book 1:	Output listings of preliminary data.
a.	General Utilization Measures Report by Room Type.
b.	Building Inventory Structure Report by Room Type.
c.	Building Inventory Structure Report by Department and Room Type.
d.	Utilization by Building, Department and Room Type.
e.	Fit of Projection of Instructional Programme in Existing Facilities.
Book 2:	Output listings of final tabulations.
a.	Building Inventory - Fall, 1964.
b.	Summary Card Listing.
c.	Instructional Room Utilization Analysis Fall, 1964.
d.	Programme Projection - 1970.

All the above materials are in the hands of the Director of Physical Resources.

SUMMARY AND RECOMMENDATIONS

Section 1. - Outlines Study Objectives And Methodology

- Study establishes University-wide space utilization data capable for inclusion in continuing space inventory and assignment procedures
- Study indicates areas where University can improve utilization
- Study indicates probable dimensions of 1970 space programme for instructional and related space needs
- Study outlines space assignment procedures for improving space utilization
- Section concludes with description of eight step methodology

Section 2. - Describes the Characteristics Of Space At The University Of Guelph In The Fall 1964

- University stock consisted of 78 major buildings and 58 minor structures
- Total gross square footage was approximately 1.80 million square feet
- Total net assignable square footage was 1.25 million square feet
- Non-residential floor space was 1.075 million square feet
- Typical assignable square feet per full time equivalent student in universities is approximately 180 to 250 square feet. University of Guelph has 600 assignable square feet per student
- High average due in part to specialized nature of curriculum and in part due to low utilization of plant

- Of 86 classrooms on campus, only 62 were used for instructional purposes Fall 1964.
- Of 351 laboratories only 58 were used for scheduled teaching
- Office space was in short supply
- Library space was extremely deficient
- Museum and gallery space was in short supply
- Physical education space was adequate
- Infirmary and health services space was very low
- Physical plant and maintenance space was high, though location and quality problems existed

Section 3. - Describes How Space Was Used At The University Of Guelph, Fall 1964

- Stresses importance of using space utilization studies as part of the planning process
- Classrooms, lecture halls and seminar rooms were used on the average of only 14.1 periods per week, with a student station occupancy of 43.2 per cent overall; 49.0 per cent when room was in use
- Teaching laboratories were used on the average of 10.6 periods per week with a station occupancy averaging 76 per cent
- Room by room period use varied from a low of one period per week to 26 periods per week
- Percentage of stations occupied varied on a room to room basis from 10 percent to a 100 percent
- Student contact hours average 30 hours per week compared to 16 to 18 hours in typical universities. This due to the specialized nature of the present curriculum
- Average number of student stations per room was

93.5; average number students per class was 41.9; which accounts in part for low utilization

- - - - - - - - - - - - - - -

- RECOMMENDS THAT AVERAGE PERIODS PER ROOM PER WEEK FOR CLASSROOMS BE RAISED TO 17.0 BY 1966 AND 28.0 BY 1970
- RECOMMENDS THAT AVERAGE PERIODS PER ROOM PER WEEK FOR LABORATORIES BE RAISED TO 12.0 BY 1966 AND 20.0 BY 1970
- RECOMMENDS THAT OVERALL AVERAGE PERCENT OF STATIONS OCCUPIED IN CLASSROOMS BE RAISED TO 50% BY 1966 AND 67% BY 1970
- RECOMMENDS THAT OVERALL AVERAGE OF STATIONS OCCUPIED IN TEACHING LABORATORIES BE RAISED TO 80% BY 1966 AND CONTINUED THROUGH TO 1970

Section 4. - Describes General Strategies For Improving Utilization Of Space

- RECOMMENDS THAT NORMATIVE UTILIZATION STANDARDS BE APPLIED TO BOTH EXISTING AND NEW FACILITIES
- RECOMMENDS THAT NEW CONSTRUCTION EMPHASIZE THOSE FACILITIES NOT PRESENTLY IN PHYSICAL PLANT STOCK
- RECOMMENDS THAT QUALITATIVE CHANGES CONVERSIONS TAKE PLACE FIRST IN THOSE EXISTING ROOMS WHICH ARE OVERSIZED AND UNDERUTILIZED
- LISTS ALL TEACHING BUILDINGS AND INDICATES THE TYPE OF RENEWAL ACTION WARRANTED FOR UTILIZATION PURPOSES

Section 5. - Reviews All Teaching Rooms And Indicates Appropriate Action For Improving Utilization

- Describes existing stock

- Lists all classrooms by
    - building number
    - building code
    - room number
    - age of building
    - assignable square feet
    - number of student stations
    - stations occupied 1964
    - period utilization 1964
    - rates location for utilization
    - rates size for utilization
    - rates quality of environment
    - indicates utilization expectations
    - suggests recommended use
    - indicates renewal action

- RECOMMENDS ROOMS FOR IMMEDIATE ARCHITECTURAL STUDY (SEE TABLE 5.1)
- RECOMMENDS CAREFUL SCRUTINY OF NEW LABORATORY SPACE REQUESTS FOR UTILIZATION STANDARDS
- RECOMMENDS DEVELOPMENT OF MULTI-PURPOSE LABORATORIES FOR BASIC SCIENCES
- RECOMMENDS CONVERSION OF OBSOLETE RESEARCH LABORATORIES IN CENTRAL CAMPUS TO BASIC SCIENCE LABORATORIES
- RECOMMENDS UNIVERSITY STAFF UNDERTAKE QUALITATIVE REVIEW OF EXISTING LABORATORIES
- RECOMMENDS UNIFORM OFFICE ASSIGNMENT PROCEDURE AS PART OF SPACE UTILIZATION ACTIVITIES
- RECOMMENDS BASIC FURNISHINGS FOR OFFICES

Section 6. - Describes And Recommends Techniques For On-Going Space Assignment And Space Planning Procedures

- Describes opportunities and benefits to be derived from space utilization procedures
- Outlines basic data available and limitations therein
- Describes space assignment techniques proposed for University of Guelph
- Indicates areas where extension of technique can become useful management tool

- - - - - - - - - - - - - - -

- RECOMMENDS THAT UNIVERSITY BEGIN SPACE ASSIGNMENT PROCEDURES AT ONCE

Section 7. - Estimates Instructional And Related Space Needs To 1970

- Defines instructional and related space needs
- Indicates how space programmes can be derived from course projection figures and utilization goals
- Calculates total instructional and related space needs at 1970 to be 558,000 square feet
- Indicates range of savings in construction costs already evident in application of standards to first phase Arts Building

- - - - - - - - - - - - - - -

- RECOMMENDS THAT 98 SQUARE FEET PER STUDENT OVERALL OF INSTRUCTIONAL AND RELATED SPACE BE CONSIDERED A SPACE PLANNING GOAL

SECTION I

INTRODUCTION TO STUDY

1.1 Background

In the summer of 1964, as part of a series of exploratory studies leading to the publication of a long-range development plan for the University of Guelph, the Consultants briefly examined the use of space on campus in order to determine the possible benefits of including a systematic space management procedure in the planning process.

The exploratory study indicated that the existing space was under-utilized: sometimes because of environmental handicaps in the use of space; partially because there were not sufficient students to fill all the space available; and occasionally because the University did not have a University-wide space utilization policy or procedure. The study also indicated a lack of uniform data on size, condition and functional uses of rooms and buildings.

Discussions with the University about other matters indicated that in order to accommodate its initial enrollment the University's new academic unit, Wellington College, would have to share space now used by other academic units until new construction could be funded and completed. There was reason to believe that some of the existing teaching space would have to be renovated or altered to meet these emerging needs. Since this could represent a sizeable investment in capital funds, decisions would have to be made as to which rooms and buildings so treated would have longest term usefulness.

Against this background the Consultants recommended, and the University approved, the undertaking of a detailed space utilization study. The following objectives were then accomplished.

1.2 Objectives

1. The study establishes a University-wide space inventory capable of providing data on the kinds of space available and how they are being used. The inventory is arranged so that data processing summaries can help evaluate the utilization of space. As a permanent inventory, the system is designed for amendment and change as part of a continuing procedure.
2. The study indicates areas where the University could increase the utilization of space through the improved space assignment policies, standards, and procedures.
3. The study estimates the University's instructional and related space requirements to 1970 and: (a) establishes the probable size of total space requirements for instructional and related research needs, applying normative utilization standards to the existing space; (b) identifies the amounts and possible location of space available for academic units needing interim space during the early construction phases; (c) indicates buildings and rooms where investment in renovation would probably return the

highest utilization rate.

4. The study outlines a space assignment procedure so that the University can systematize its operations in this area, as well as conduct periodic evaluations of the use of space.

1.3 Methodology

A full description of the methodology used in preparing this report was distributed to the participants at various stages of the study. Copies are available for inspection by others in the Office of the Director of Physical Resources. This is a synoptic account of how the study was completed.

There were seven steps:

1. An inventory of all existing spaces on campus.
2. A projection of instructional and related space needs to 1970.
3. An evaluation of existing use of space.
4. Identification of the probable existing stock of teaching spaces at 1970.
5. Establishment of criteria for upgrading the use of the existing teaching spaces.
6. Recommendation of actions for improving the use of existing teaching spaces.
7. Establishment of procedures for a continuing space management system, including recommended standards of utilization.

Step 1. Inventory of Existing Space On Campus

Special data processing forms were devised for the inventory of existing rooms and buildings. Information recorded included building number, floor level, room number, room type, departmental affiliation, function, net floor area, width and length of room, actual number of stations, computed number of stations, station type and general equipment.

The University thus now has available on IBM keypunch cards a complete descriptive inventory of all rooms on campus. The inventory is arranged for continuing amendment and change, so as to allow immediate recording of all space changes.

Step 2. Projection of Instructional And Related Space Needs To 1970

The forecasting of future needs was made by each department head for each course, existing or contemplated, to 1970. The forecast covered such matters as section type, existing section size, projection factors, optimum desired size of class sections, number of class sections, weekly meeting periods per section, room type.

Individual departmental needs were scrutinized against the background of total enrolments expected by 1970. Deviations and atypical situations were examined and explained. Through the use of a computer programme, specially written for that purpose, the teaching forecast was summarized and translated into teaching space requirements.

Using normative standards, other related space needs were calculated: departmental and faculty office needs, research needs as related to teaching faculty, service and supporting space.

By subjecting these forecasts to normative space utilization standards the probable size of the instructional and related space needs were thus determined.

Step 3. Evaluation Of Existing Use Of Space

Using a data retrieval programme written for an IBM 7044 computer, the relevant summaries of the existing use of space were calculated and examined against normative standards applicable to the University's present enrollment level, as well as in terms of historical events peculiar to the University's past development.

Step 4. Establish Size Of Existing Stock Of Teaching Spaces To 1970

Like most mature institutions the University's inventory includes buildings which are functionally obsolete, and/or in a declining condition because of inherent deficiencies in structure or type of building materials. These buildings, when occupying central sites on campus, eventually must make way for more intensive use of land and replacement of such space. Obviously such actions remove a designated portion of teaching spaces from the possible stock.

In this step of our study the probable quantitative and qualitative changes in existing teaching spaces were identified on the basis of the staging requirements for the long range plan and building location in that plan, as well as the consultants' preliminary examination of building condition.

Step 5. Establish Criteria For Upgrading Of The Existing Use Of Space

Room by room all existing teaching spaces were examined and reported on with reference to how well they were being utilized in the Fall 1964, and what measures could be taken to improve utilization to 1970. Where information was available, suggestions for qualitative changes were made based on initial reviews of the rooms' susceptibility to a renewal programme - i.e., rehabilitation, modernization and alteration.

Step 6. Establishment Of Procedures For A Continuing Space Management System, Including Recommended Standards Of Utilization

The procedures recommended were based on the best aspects of existing systems in operation elsewhere, and especially adjusted for the University of Guelph. Continuing discussions with the University administration throughout the study helped the consultants suggest a workable system. These matters are covered in some detail in the pertinent parts of the report.

Step 7. Outline Probable Dimensions Of New Construction Required To Meet Projected Teaching Programme Requirements

Essentially this step involved an evaluation of the material produced in projection of 1970 needs (Step 2), with allowances for the stock available in 1970 (Step 4), and the anticipated meeting of the utilization rates recommended in Step (6) and Step (7).

Contents Of The Report

The substantive items of existing use, anticipated qualitative and quantitative change, and procedures and recommendations for improving the use of space are fully described in the sections that follow. In order to reduce the size of the report and make it more useful for the general reader, the technical summaries - especially the computer printouts - have not been included. Copies are available at the Office of the Director of Physical Resources.

The study includes an outline of immediate actions to be taken to implement the major recommendations outlined in the study.

Acknowledgements

We are particularly grateful for the co-operation received from the department heads and senior administra-

tive officers during the course of the study. This has been a collaborative effort between the Consultants and the University, which is essential to maintain "planning as a process" for guiding the physical development of an important national University.

SECTION 2

SPACE AT THE

UNIVERSITY OF GUELPH

FALL 1964

2.1 The Building Stock

This section describes the existing stock of buildings and spaces as inventoried in the summer and fall of 1964.

The Consultant's studies indicated there were 78 major buildings and 59 minor structures. The major buildings totalled about 1.80 million gross square feet, of which the net assignable square footage was 1.25 million square feet.

Of the 78 major buildings 31 were affiliated with OAC, 17 with OVC, 3 with Macdonald Institute, 3 were joint or special use facilities and 24 were assigned to general University use.

As to age, 12 buildings were constructed prior to 1900, 14 in the period 1900 - 1919, 19 between 1930 - 1939, six from 1940 - 1949, 18 from 1950 - 1959, and nine since 1960. The general trend indicates a steady growth in construction to 1940, a drop during the war years, and then a significant increase in the period following. About a third of the space on campus, however, has been built in the last ten years.

The largest building on campus is the Administration Building, constructed in 1931 and totalling 144,000 square feet. The only other buildings over 100,000 square feet are the Chemistry-Microbiology building (113,000 square feet) and the Physical Education Building (110,000 square feet).

Our surveys showed that red brick, in various tones, was the predominant building material, 48 buildings being in that category. Fourteen buildings were listed as frame materials, 8 as stone, 2 as steel, 1 as glass and iron, and 5 as cinder/concrete block structures.

Table 2.1 (Building Survey - University of Guelph 1964) summarizes the significant building data as inventoried by the Consultants in the summer, 1964. (page 11)

2.2 Definitions Of Space As Used In This Study

Space --- in this study --- means enclosed floor area used for the educational, research and public service functions of the institution and the necessary supporting activities.

Two kinds of floor area measures are used:

1. Gross Square Feet (gsf) -- the area enclosed at each floor level of a building within the exterior walls, measured outside the exterior walls. (Unit cost figures usually are expressed as average dollars per gross square foot).

2. Assignable (or Net) Square Feet (asf) -- The actual inside area of rooms or other spaces within a building assignable to a specific function. This measure

TABLE 2.1

BUILDING SURVEY

UNIVERSITY OF GUELPH 1964

CODE #	BUILDING NAME	AFFILIATION	BUILDING MATERIAL	GROSS SQ. FT.	YEAR CONST.	CONDITION *	
						EXT.	INT.
66	Sheep Barn	OAC	Frame	16,400	1879	2	2
5	President's Res.	Univ.	Stone	NA	1882	NA	
10	Bursar Hall	Univ.	Stone	5,400	1882	2	2
22	Residence	Univ.	Stone	NA	1882	NA	
52	Beef Barns	OAC	Frame	47,040	1886	3	3
15	Engineering Annex	OAC	Brick	11,340	1891	2	3
23	Extension Education	Univ.	Brick	18,150	1892	3	4
34	Nutrition Building	OAC	Brick	7,140	1893	3	3
35	Incubator Building	OAC	Brick	7,410	1893	3	4
16	Animal Husbandry	OAC	Brick	18,420	1895	3	3
55	Power Plant	Univ.	Brick	16,878	1895	2	2
12	Chemistry	OAC	Brick	23,175	1896	4	4
69	South Barn	OVC	Frame	4,900	1900	4	3
25	Economics	OAC	Brick	22,100	1901	2	2
17	Judging Pavilion	OAC	Brick	3,850	1902	2	2
1	Mac. Institute	MI	Brick	86,284	1903	2	2
2	Mac. Hall	MI	Brick	70,920	1903	2	2
24	Massey Hall	Univ.	Brick	29,050	1903	3	3
3	Mac. Cons. School	-----	Brick	11,088	1904	3	3

Table 2.1 continued

CODE #	BUILDING NAME	AFFIL- IATION	BUILDING MATERIAL	GROSS SQ. FT.	YEAR CONST.	CONDITION* EXT.	INT.
58	Grounds Office	Univ.	Brick	20,312	1906	3	2
14	Agr. Engineering	OAC	Brick	42,840	1906	2	2
37	Dairy Barn	OAC	Frame	29,556	1912	3	3
21	Field Husbandry	OAC	Brick	35,500	1913	2	3
7	Creelman Hall	Univ.	Stone	30,392	1914	2	3
32	Graham Hall	OAC	Brick	25,960	1914	3	2
26	Physics	OAC	Brick	26,880	1916	2	3
63	Residence	Univ.	Brick	NA	1920	NA	
78	Residence	Univ.	NA	NA	1920	NA	
8	Mills Hall	Univ.	Stone	49,895	1920	2	2
20	Apiculture	OAC	Brick	12,288	1920	2	3
38	Dairy Building	OAC	Brick	44,616	1921	2	2
39	OVC Main Bldg.	OVC	Brick	42,340	1922	2	2
41	Laboratory Building	OVC	Brick	5,248	1922	2	2
45	Residence	Univ.	Brick	NA	1922	NA	
47	Residence	Univ.	Brick	NA	1922	NA	
9	Memorial Hall	Univ.	Stone	21,645	1924	2	2
33	Meat Laboratory	OAC	Brick	9,528	1924	3	2
4	Watson Hall	MI	Brick	17,100	1927	2	2
59	Trent Institute	OAC	Brick	11,240	1927	3	3
62	Associate Dormitory	OAC	Brick	13,720	1927	3	3
65	Water Tower	Univ.	Steel	490	1930	2	-

Table 2.1 continued

CODE #	BUILDING NAME	AFFILIATION	BUILDING MATERIAL	GROSS SQ. FT.	YEAR CONST.	CONDITION*	
						EXT.-	INT.
28	Horticulture	OAC	Brick	39,032	1930	2	2
29	Greenhouses	OAC	Glass	43,971	1930	2	2
11	Administration	Univ.	Stone	144,380	1931	2	3
61	Grounds Dept.	Univ.	Brick	2,838	1931	3	3
40	OVC Extension	OVC	Brick	48,159	1942	2	2
42	Animal Hospital	OVC	Frame	15,698	1942	3	3
49	Bull Barn	OAC	Frame	6,800	1942	2	2
6	Microbiology	OAC	Frame	16,980	1944	4	3
13	Chemistry Annex	OAC	Frame	15,000	1946	4	3
36	Judging Pavilion	OAC	Frame	7,842	1947	3	3
76	Laboratory Animals	OVC	Steel	1,400	1951	2	2
73	Laboratory Animals	OVC	Block	2,550	1951	2	2
53	Fire House	Univ.	Brick	1,350	1951	2	2
74	Offices	OVC	Frame	3,600	1953	2	3
51	Seed Cleaning Building	OAC	Brick	27,500	1954	2	2
75	Dog Colony	OVC	Block	2,100	1954	2	2
54	Vehicle Storage	Univ.	Brick	29,250	1957	2	2
57	Paint Shop	Univ.	Brick	11,468	1957	2	2
60	Laundry	Univ.	Brick	19,305	1957	2	2
64	Field House	Univ.	Frame	3,640	1958	2	2
71	Laboratory Animals	OVC	Block	4,550	1958	2	2

Table 2.1 continued

CODE #	BUILDING NAME	AFFIL-IATION	BUILDING MATERIAL	GROSS SQ. FT.	YEAR CONST.	CONDITION* EXT.	-INT.
72	Radio Isotcpe Studies	OVC	Block	2,800	1958	2	2
50	Phys. Ed. Bldg.	Univ.	Brick	110,665	1958	2	2
48	Science Service	-----	Brick	NA	1958	NA	
70	Piggery	OVC	Block	10,200	1959	2	2
18	Soils	OAC	Brick	47,700	1959	2	2
19	Soils Greenhouses	OAC	Brick	7,764	1959	2	2
30	Refrigerated Storage	OAC	Brick	12,868	1959	2	2
68	Mink Ranch	OVC	Frame	3,000	1960	2	2
67	Mink Ranch	OVC	Frame	4,500	1960	2	2
77	Driving Shed	OVC	Frame	2,800	1960	2	2
56	Generator Bldg.	Univ.	Brick	11,968	1960	1	1
31	Biology Bldg.	OAC	Brick	80,600	1961	1	1
43	Artificial Breeders	NA	Brick	13,000	1963	1	1
44	Surgical Wing	OVC	Brick	65,667	1963	1	1
46	Poultry Pathology	OVC	Brick	32,600	1964	1	1
27	Chemistry & Micro.	OAC	Brick	113,600	1965	1	1
	TOTAL			1,805,874			

Table 2.1 continued

The buildings' external and internal conditions were evaluated on a scale 1 - 4, good to poor.

Source: Programme for Development, September, 1964.

The gross square footages listed above were derived from the following sources:

A. Data provided to Consultants by the Buildings and Grounds from recent architectural drawings:

B. Data obtained by the Consultants by scaling existing drawings:

C. Data obtained by the Consultants by actual measurement of the buildings.

The buildings in each of the above categories are:

Category A.	3, 8, 9, 10, 11, 27, 31, 38, 43, 44, 46, 50, 53.
Category B.	1, 4, 7, 12, 13, 14, 15, 16, 18, 19, 20, 21, 23, 24, 25, 26, 30, 32, 39, 40, 49, 51, 52, 54, 55, 56, 57, 58, 60, 62, 65.
Category C.	2, 6, 17, 28, 29, 33, 35, 36, 37, 41, 42, 59, 61, 64, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77.
NA	5, 22, 45, 47, 48, 63, 78.

excludes the gross area of walls, columns, ducts, shafts, partitions, corridors, stairs, and building service areas such as rest rooms, janitorial closets, mechanical and electrical service rooms, etc.

Assignable area may vary from 50 to 90 per cent of gross area depending upon the density of partitions, the extent of circulation areas, and the mechanical requirements of a building. Typically it averages about 65 per cent over a large number of institutional buildings.

Most references in this report will be to assignable (or net) square feet. The detailed building space inventory carried out in the study includes the inside dimensions of every room in every substantial building in the University of Guelph, identified by the building, room number, and room type.

2.3 Summary Of Existing Building Space

Room types are coded for data processing according to basic functions and use characteristics, insofar as these could be determined in the inventory survey. These type categories serve to define the "utilization" of the physical plant in terms of how the building space is allocated to various types of uses.

On Table 2.2 the assignable square feet of building space by room type is summarized, divided into two general categories -- Academic and General and Supporting facilities. (see page 17).

The University of Guelph has a total of 1,250,000

TABLE 2.2

SUMMARY OF ASSIGNABLE SQUARE FEET OF BUILDING SPACE,

UNIVERSITY OF GUELPH

FALL 1964

(PRELIMINARY TABULATION)

ROOM* TYPE CODE	ROOM TYPES	NUMBER OF ROOMS	ASSIGN. SQUARE FEET	PER CENT SUBTOTALS	PER CENT TOTAL
ACADEMIC AND GENERAL FACILITIES.					
1100	Offices	639	116,068	12.0	9.3
1200	Classrooms, Lec., Sem.	86	98,440	10.2	7.9
1300	Laboratories & Other Special Purpose Rooms	351	207,170	21.5	16.6
1400	Instruction-Related	2	113	----	----
1500	Student-Staff Service	79	29,061	3.0	2.3
1600	Service Areas	1,231	417,358	43.4	33.4
1700	Library	34	28,725	3.0	2.3
1800	Museum & Gallery	5	14,362	1.5	1.1
1900	Physical Education	11	51,819	5.4	4.1
	Subtotal - Academic and General -	2,438	963,116	100.0	77.0
SUPPORTING FACILITIES.					
2000	Residential	488	136,339	47.5	10.9
2100	Food Service	27	30,677	10.7	2.4
2200	Infirmary	22	8,267	2.8	0.7
2300	Auxiliary Enterprises	31	6,146	2.1	0.5
2400	Physical Plant Oper.	158	106,125	36.9	8.5
	Subtotal - Supporting	726	287,554	100.0	23.0
GRAND TOTALS		3,164	1,250,670	-----	100.0

Source: Preliminary Machine Tabulation, Form A.

* Such as drafting rooms and studies.

assignable square feet of building space, according to the inventory, in the Fall Term of 1964. Three-fourths of this space is assigned to academic and general uses. If physical plant and auxiliary enterprise space is added to academic and general space, a total of 1,075,000 a.s.f. of nonresidential floor space exists.

2.4 General Comparisons With Other Institutions

Although comparisons with other institutions are difficult to make, due to lack of uniform reporting of available data, several observations may be made about the structure of the building space distribution summarized in Table 2.2.* (see page 17).

In general, the smaller the institution, the larger is the average floor area of nonresidential space per full-time equivalent student (FTE). This is due to the need of any institution to have a substantial amount of "overhead" space for administration, physical plant operation and maintenance, etc. Programmes in the sciences, engineering and agriculture will use more space than the humanities and social sciences, and the larger the proportion of research and graduate training in the programme, the larger the average floor area required per FTE student.

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*General comparisons may be made with data published in the California and Western Conference Cost and Statistical Study, 1954-55, and the Restudy of the Needs of California in Higher Education (1955). The technical consultant on this study also has drawn upon his experience with the eight Colorado state-supported institutions and at the University of Rochester in developing this evaluation.

Large universities with extensive agriculture and engineering programmes appear to average about 180 to 250 a.s.f. per FTE student. As the proportion of loads in the humanities and social sciences increases, the average floor area per student in nonresidential facilities diminishes rapidly. The 18 institutions covered in the California and Western Conference ("Big-10") Cost study in 1954-55 averaged about 160 a.s.f. per FTE student in nonresidential floor area. The California "Restudy" standards work out to an average of 150 a.s.f. per FTE for University campuses of 2,000 students, 134 a.s.f. per FTE at the 6,000 student size, and 130 a.s.f. per FTE at the 10,000 student level.

The University of Guelph in 1964-65, with 1,075,000 a.s.f. of nonresidential floor space and approximately 1800 FTE students, averaged approximately 600 a.s.f. per FTE. In comparison with other multipurpose institutions, this is a high average and is due in part to the specialised nature of the three existing colleges and the large amounts of space needed by agriculture and veterinary medicine.

A good comparison can be made with the Davis Campus of the University of California, where agriculture, veterinary medicine, and home economics were the predominant subject areas a decade ago. In 1953, Davis averaged 541 a.s.f. per FTE student with 1500 FTE.* At that time

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* Restudy of the Needs of California in Higher Education, pp. 317-318. See also p.352.

Davis was judged to be underutilizing its space in several categories.

2.5 Comments On Guelph Building Space Structure

Within the specific room type categories of existing space at the University of Guelph, the following observations may be made:

In Table 2.2, the general type category "1100 - Offices" numbers 639 rooms and 116,068 assignable square feet. For an existing population of about 400 faculty and professional staff and a supporting staff of over 600, no surplus of office space appears available.

In spite of the fact that classrooms, lecture rooms and seminar rooms constitute only 8 per cent of the total floor area, there is a substantial surplus of classroom space. As will be shown in Section 3, only 62 of 86 inventoried rooms in this category were used for scheduled classes in the fall of 1964. Even in the 62 classrooms used for scheduled instruction, the level of utilization was very low by normative standards. The fact that some of these rooms have qualitative deficiencies and are not likely to be heavily used because of their size makes this category of space the prime candidate for conversion to more urgently needed uses especially faculty offices, in the next five years.

Of the 351 rooms and 207,170 a.s.f. in the general type "1300 - Laboratories and Other Special Purpose," only 58 rooms covering 75,000 a.s.f. of space were used for scheduled instruction in the fall of 1964. The balance of laboratory space is largely for the extensive research activities of the University. This is not an excessive amount for this type institution, but levels of utilization can be substantially increased in teaching laboratories and in many of the research spaces.

The category "1600 - Service Areas" is strikingly large. Since this category includes animal quarters of all types, the large portion of space in this category is explained by the nature of the existing colleges. This type of space must be carefully scrutinized to avoid the buildup of dead storage.

Library space is extremely deficient by any standards, as the institution is acutely aware, and no further comment seems necessary.

Museum and gallery space is in short supply. Physical education space appears to be adequate for present needs and should serve some expansion of programme and student population.

The proportion of residential and food service space is not large, considering the location of the institution, and is now being expanded to meet the student population growth anticipated. The amount of infirmary space is clearly deficient, in qualitative terms as well as in anticipation of growth in enrolments and staff.

The amount of physical plant operation and maintenance space inventoried would be adequate for a much larger institution, although qualitative and locational problems appear to exist in some of the plant space.

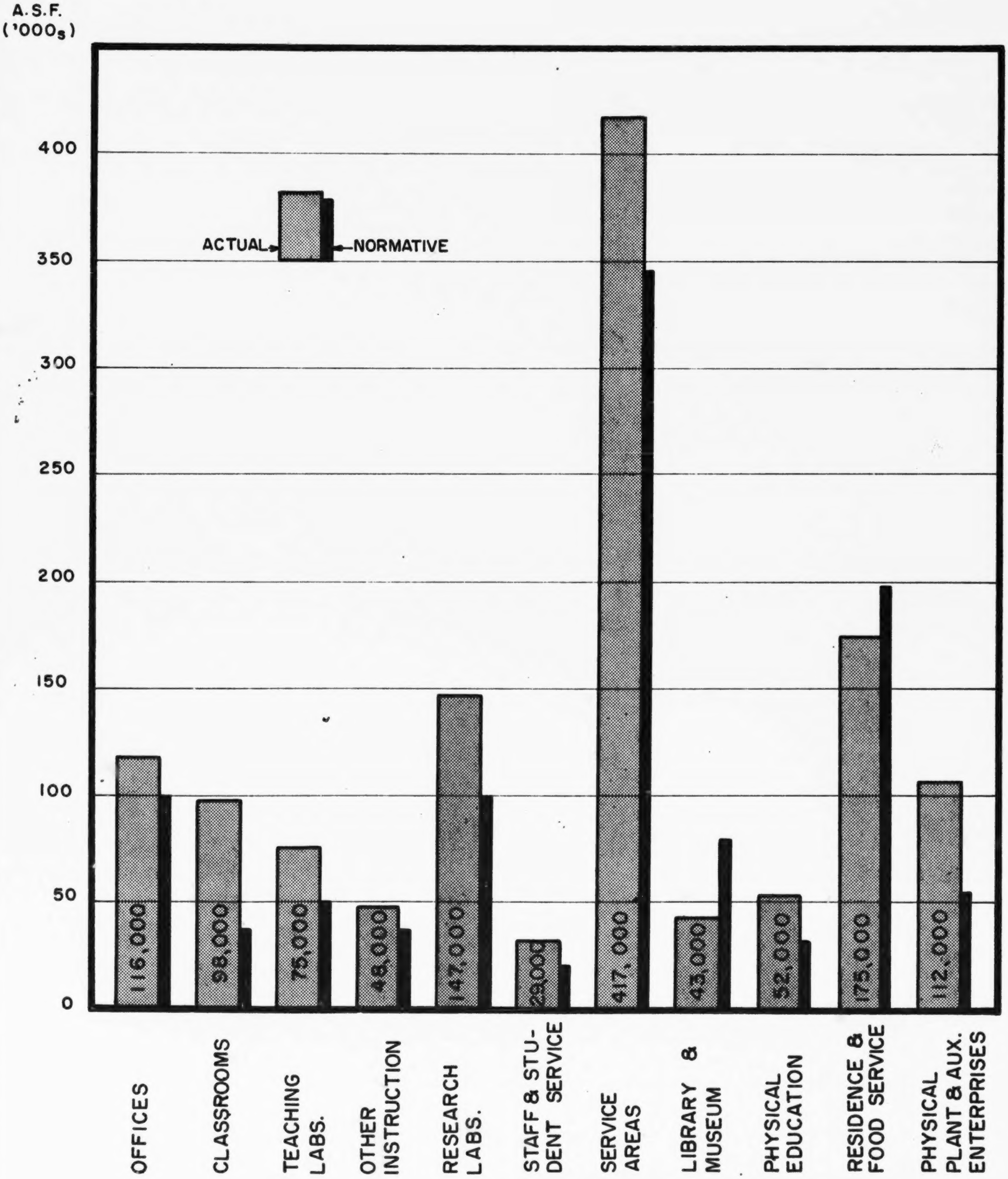
A graphic profile of the distribution of building space at the University of Guelph in 1964-65 by general room type is shown in Figure 2.1. (Page 23) The larger bars show the actual square footage inventoried at Guelph. The narrower, dark bars show the amounts of floor area that would have been adequate for the size of the programme in the fall of 1964 by general normative standards typical of colleges and universities. This comparison is an abstract one and is meant only to be suggestive of the capacity of the existing plant to absorb additional growth. Qualitative deficiencies and inefficient room sizes will limit the actual capacity of existing facilities.

During the next few years, the most critical space problem in the University will be the initial growth of Wellington College. The types of space needed for its new programmes are primarily faculty offices, classroom space, and library facilities. This focuses attention upon the existing classroom space, of which there is now a substantial surplus. By more intensive use of classrooms, and by conversion of some classroom space to offices, the initial programmes of Wellington can be accommodated. Later sections of this report demonstrate the ways and means of accomplishing that development.

FIGURE 2.1

PROFILE OF ASSIGNABLE BUILDING SPACE AT UNIVERSITY OF GUELPH

1964 - 1965



SECTION 3

HOW SPACE WAS USED AT THE UNIVERSITY OF GUELPH

FALL TERM 1964

3.1 Space Utilization And The Planning Process

As was suggested in the general evaluation of existing facilities in the previous section, the University of Guelph as of the fall of 1964 has a surplus of most types of space by abstract normative standards. For the size of its student population at that time it could theoretically have gotten by with 20 per cent less floor space in the aggregate. But much of the space was highly specialized and not easily assigned to other uses. Furthermore, since buildings are always built to allow for growth in the future, the University would be faced with greater difficulty if it did not have room for expansion, especially when confronted with the prospect of tripling its enrolment in five years.

Given the length of time required to plan, design, and build a major building, a University must always expect to build ahead of need. A single new building may thus create a temporary over-supply of certain categories of space while other kinds may be deficient at the same time. On the other hand, buildings constructed for too distant a future may be threatened with early obsolescence, given the mutable nature of instruction and research in the modern university. A major planning objective is to maintain a reasonable balance of facilities over time.

The staging of events, as recommended in the Long Range Development Plan, is thus important to sustain a smooth flow of capital funding requirements, to achieve a reasonable equilibrium of facilities with a growing and inconstant demand, and to insure that change can be accommodated in new kinds of facilities as new demands arise.

It has been a common fault of utilization studies that they are not used as a planning tool in this process. The studies are too often not followed up with schedule building and project planning that lead to remedial action.

Classrooms in older college buildings usually were built in excessive quantity and in sizes too large for the typical class size distribution of the institution. The result: low utilization measures in most institutions.

Trustees and government agencies sometimes have tended to misinterpret these low utilization rates to mean that an institution does not need new buildings, not understanding that scheduled classrooms and teaching laboratories consume only 10 to 15 per cent of the total assignable floor area of a complex, multipurpose university.

Nevertheless, considerable floor space can be saved if instructional space is utilized at reasonable levels. Better utilization may even lead to a surplus of classroom space, though with increasing enrolments this may create a critical shortage of faculty offices and research space. A typical remedial action growing out of instructional space utilization studies in such instances is conversion of excess classroom space to other needs.

The University of Guelph clearly has such an opportunity.

3.2 Limits Of Analysis Of Active Utilization

The analysis of the inventory of existing space by room type in Section 2 was a static analysis of the physical plant. This section is concerned with the dynamic utilization of scheduled instructional space, classrooms and teaching laboratories. For the reasons noted below evaluation of space utilization must be limited to these categories.

In a multipurpose university, the "productive" space is composed of the classrooms, teaching laboratories, research laboratories, faculty offices, and library. All other space, although nonetheless essential to the functioning of the basic activities of the university, is supportive.

Of course, the essential requirements for administration, plant maintenance, staff and student services, storage, preparation rooms, animal quarters, etc., must be adequately met, or the basic functions will be impaired. But the need for such supporting space can only be appraised in the most specific terms by those with an intimate knowledge of the specific functions of the institution. Except in the gross terms outlined in Section 2, it is not possible to evaluate the active utilization of such space by statistical measures or comparisons with other institutions.

For similar reasons no attempt is made to evaluate the use of research space. The abstract normative measures applied in Section 2 suggest that if all of the research space were ideally organized in modern facilities, less space would have been needed in the fall of 1964. Universities, however, never seem to have enough research space. From all indications, the University of Guelph is no exception to the general trends evident elsewhere. There are substantial demands for additional research space in the long-range development programme.

The utilization of office space can be measured only by occupancy. No excess appears in evidence, and the impending enlargement of faculty and staff associated with the development of Wellington College constitutes an immediate shortage.

3.3 Scheduled Utilization Of Instructional Space

Formal instruction in scheduled class meetings constitutes the principle, although by no means the only mode by which the educational functions of a university are performed. A given group of students, meeting in a scheduled time and place, to pursue their educational programmes under the guidance of an instructor, is the basic kind of activity for which classrooms and special purpose instructional facilities must be provided. North American universities, representing a unique fusion of Scottish, English, and Germanic university models, offer baccalaureate degrees achieved primarily by participation in formally scheduled courses. The similarity of these programmes in structure, if not in content, is so great that a generally applicable methodology for measuring space utilization has evolved. Large numbers of colleges and universities have carried out such studies with the same methodology, permitting the development of comparative norms by which the utilization levels of a given institution may be measured.*

In the following analysis, the active utilization of scheduled instructional space at the University of Guelph in the fall of 1964 is measured and compared with available normative data gathered from similar space utilization studies elsewhere.

During the fall of 1965, the University's classrooms, lecture halls, and seminar rooms were scheduled an average of only 14.1 periods per week per room. When these rooms were in scheduled use, only 43.2 per cent of the student stations were occupied, on the average. Teaching laboratories were scheduled only 10.6 periods per week on the average, but with a good level of station occupancy, approximately 76 per cent.

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* The methodology has been promulgated in John Dale Russell and James I. Doi, Manual for Studies of Space Utilization in Colleges and Universities, Athens, Ohio: American Association of Collegiate Registrars and Admissions Officers, 1957. The normative data used here was compiled in James I. Doi and Keith L. Scott, Normative Data on the Utilization of Instructional Space in Colleges and Universities, American Association of Collegiate Registrars and Admissions Officers, July 1960.

The data from which these measures are drawn and the indices of utilization applicable are given for each classified type of instructional room in Tables 3.1 and 3.2.

The basic data summarized in Table 3.1 (page 33) was compiled from information supplied by the departments regarding the time and place of meeting, section types, student course enrolments, and course structure of each class section taught at the University in the survey period. This information was keypunched and compiled by computer. A room-by-room analysis of utilization levels and qualitative evaluation has been made and is described in Section 4. This section deals with the university-wide summary data and overall utilization measures.

The summary of instructional programme data in Table 3.1 shows that formally scheduled classes were held in 167 rooms totalling 197,639 assignable square feet. Class meeting periods totalled 1,896 per week, with 21,918 student course enrolments. These classes generated 54,823 student periods per week (equivalent to student contact hours or student clock hours) -- an average of over thirty periods per student per week. (Note: This is a very high average. Most colleges and universities average 16 to 18 periods per week per full-time student. The high rate at Guelph is due, apparently, to the large portion of laboratory time in the veterinary medicine, agriculture, and home economics programmes).

Sixty-three classrooms, lecture halls, and seminar rooms were used for scheduled instruction. The building space inventory (See Table 2.2, page 17) identified 85 rooms classified as 1200-type classrooms. The 22 rooms in which no instruction was scheduled include War Memorial Hall (counted as 2 units), 6 rooms in the Chemistry-Microbiology building not yet opened for use, 2 rooms that are actually laboratories, and 2 highly specialized demonstration rooms. The remaining 10 classrooms may have been used, but not for scheduled instruction as recorded in the survey.

Fifty-nine out of 350 laboratory-type rooms were used for formal teaching laboratory instruction. An additional 45 rooms (a mixture of offices, research laboratories, conference rooms, library rooms, physical education spaces, and rooms classified in the inventory as service rooms) were used for special purpose instruction.

These data are used to compute the common indices of instructional space characteristics and utilization rates, given on Table 3.2, page 34. The weighted averages for classrooms and lecture rooms indicate the nature of the utilization problem at Guelph. The average number student stations (actual, by inventory) per room is 93.5 (Col. 1). The rooms are predominantly large, averaging 1,271 a.s.f. per room (Col. 2). Many of the rooms (especially the "1223" special-use lecture rooms) have fewer student stations than the floor areas of the rooms would permit by normal standards (see the "computed" stations given in column 3 of Table 3.1). Thus, the average square feet per student station is high, averaging 13.6 a.s.f. per station (Col. 3), compared with 11.8 by computed standards.

The average number of students per class section meeting in classrooms and lecture halls was 41.9 (Col. 4). Compared with the average stations per room of 93.5, this indicates that the distribution of room sizes in numbers of stations per room is 100 per cent greater, on the average, than the distribution of class sizes meeting in them. This is why the weighted average percentage of stations occupied when the rooms were in use was only 43.2 per cent (Col. 6).

An average of only 15 periods per week were scheduled in these rooms (Col. 5). As a result, the classrooms stations were occupied on the average only 6.7 periods per week (Col. 7).

The last column in Table 3.2 gives an index of the assignable square feet per 100 student periods of occupancy, averaging 201.9 a.s.f. -- a high average resulting from a compounding of too large classrooms, of high square footage per station, and low utilization.

Seminar rooms, which are few in number and consume only 1900 a.s.f. of floor space, averaged only 5.2 periods per week with 43 per cent of the stations occupied.

Laboratories and other special purpose rooms by their nature have lower utilization capability. If a course requiring special laboratory facilities is to be offered, the space must be provided even though its utilization will be limited.

Regular teaching laboratories, of which 59 were used for scheduled class sections, have fewer stations per room since laboratory instruction usually must be carried out with smaller groups. The square footage per station, averaging 45.4, is to be expected because of the equipment and working space required. These teaching laboratories were scheduled an average of 10.6 periods per week in the fall of 1964, but the station occupancy averaging 76.0 per cent when the rooms were in use is very good. Laboratory sizes seem well fitted to the sizes of the classes that meet in them.

The other scheduled instructional activity, lumped together as "special purpose instruction", meets in such a diversity of kinds of facilities that the averages do not mean much except to suggest that the class groups tend to be small (much of this activity is at the graduate level) and the scheduled utilization low. In many of these rooms, significant amounts of nonscheduled activity probably takes place so that the utilization

TABLE 3.1
INSTRUCTIONAL SPACE UTILIZATION - FALL 1964
SUMMARY OF SPACE AND SCHEDULED ACTIVITIES DATA

TYPE CODE	ROOM TYPES	ΣR[1] NUMBER OF ROOMS	Σa NUMBER ACTUAL STATIONS	Σc COMPUTED STATIONS	Σf ASSIGNABLE SQUARE FT.	ΣP SCHEDULED PERIODS PER WEEK	ΣN STUDENT COURSE ENROLLMENTS	Σ (NP) STUDENT PERIODS PER WEEK	Σ (Pa) POTENTIAL STATION OCCUPANCY
1200	Classrooms - undefined [2]	9	843	923	10,689	141	2,022	5,135	12,757
1211	General Classrooms	32	3,127	3,502	40,038	460	9,106	19,204	49,307
1213	General Lecture Rooms	12	1,232	1,277	16,495	189	3,675	9,931	18,835
1223	Special Lecture Rooms	4	130	390	5,221	67	627	1,614	2,184
Total Classrooms & Lecture Rooms		57	5,332	6,092	72,443	857	15,430	35,884	83,083
1212	Seminar Rooms	6	79	93	1,906	31	105	159	370
Total Classrooms, Lecture, Seminar		63	5,411	6,185	74,349	888	15,535	36,043	83,453
1300	Laboratories - Undefined*[2]	11	237	---	12,915	86	849	2,168	2,623
1310	Home Economics Lab.	4	50	---	3,713	60	175	731	840
1311	Wet Teaching Labs	14	426	---	14,069	157	1,117	3,129	3,625
1312	Dry Teaching Labs	11	513	---	15,720	112	1,545	4,069	5,571
1313	Heavy Equipment Labs	7	166	---	11,948	47	326	949	1,306

.... Continued

TABLE 3.1
(CONTINUED)

TYPE CODE	ROOM TYPES	ΣR[1] NUMBER OF ROOMS	Σa NUMBER ACTUAL STATIONS	Σc COMPUTED STATIONS	Σf ASSIGNABLE SQUARE FT.	ΣP SCHEDULED PERIODS PER WEEK	ΣN STUDENT COURSE ENROLLMENTS	Σ (NP) STUDENT PERIODS PER WEEK	Σ (Pa) POTENTIAL STATION OCCUPANCY
1314	Variable Equipment Labs	10	229	---	15,228	99	683	2,151	2,984
1315	Drafting Rooms	2	51	---	2,288	65	363	998	1,718
Total Teaching Labs		59	1,672	---	75,881	626	5,058	14,195	18,667
All Other Special Purpose Instruction		45	843	---	47,409	382	1,325	4,585	8,901
GRAND TOTALS - All Scheduled Instruction		167	7,926	---	197,639	1,896	21,918	54,823	111,021

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[1] Σ is Sigma or sum

[2] Subtypes not identified in inventory; corrects listing of Summary Cards by transfer of Physics 108 from type 1200 to type 1300.

TABLE 3.2
INSTRUCTIONAL SPACE UTILIZATION - FALL 1964
INDICES OF UTILIZATION

TYPE CODE	ROOM TYPES	(1) AVERAGE STATIONS (ACTUAL) PER ROOM * $\frac{\Sigma (a)}{\Sigma (R)}$	(2) AVERAGE SQ. FT. PER ROOM $\frac{\Sigma (f)}{\Sigma (R)}$	(3) AVERAGE SQ. FT. PER STUDENT STATION $\frac{\Sigma (f)}{\Sigma (a)}$	(4) AVERAGE STUDENTS PER CLASS SECTION $\frac{\Sigma (NP)}{\Sigma (P)}$	(5) AVERAGE PERIODS PER WEEK PER ROOM $\frac{\Sigma (P)}{\Sigma (R)}$	(6) AVERAGE PERCENT STATIONS OCCUPIED $\frac{\Sigma (NP)}{\Sigma (Pa)}.100$	(7) AVERAGE STUDENT PERIODS PER STATION $\frac{\Sigma (NP)}{\Sigma (a)}$	(8) AVERAGE SQ. FT. PER 100 STUDENT PERIODS $\frac{\Sigma (f)}{\Sigma (NP)/100}$
1200	Classroom - undefined	93.6	1,188	12.7	36.4	15.7	40.3	6.1	208.2
1211	General Classrooms	97.7	1,251	12.8	41.7	14.4	38.9	6.1	208.5
1213	General Lecture Room	102.7	1,375	13.4	52.5	15.8	52.7	8.1	166.1
1223	Special Lecture Room	32.5	1,305	40.2	24.1	16.8	73.9	12.4	323.5
Wtd. Avg. - Classrooms & Lecture Rooms		93.5	1,271	13.6	41.9	15.0	43.2	6.7	201.9
1212	Seminar Rooms	13.1	318	24.1	5.1	5.2	43.0	2.0	1,198.7
Combined Wtd. Avg. Classrooms, Lecture & Seminar.		85.9	1,180	13.7	40.6	14.1	43.2	6.7	206.3
1300	Laboratories - undefined	21.5	1,174	54.5	25.2	7.8	82.6	9.1	595.7
1310	Home Economic Lab.	12.5	928	74.3	12.1	15.0	87.0	14.6	507.9
1311	Wet Bench Teaching Labs	30.4	1,005	33.0	19.9	11.2	86.3	7.3	449.6
1312	Dry Bench Teaching Labs	46.6	1,429	30.6	36.3	10.2	73.0	7.9	386.3
1313	Heavy Equipment Labs	23.7	1,707	72.0	20.2	6.7	72.7	5.7	1,259.0

.... Continued

TABLE 3.2
(CONTINUED)

TYPE CODE	ROOM TYPES	(1) AVERAGE STATIONS (ACTUAL) PER ROOM * $\frac{\Sigma\,(a)}{\Sigma\,(R)}$	(2) AVERAGE SQ. FT. PER ROOM $\frac{\Sigma\,(f)}{\Sigma\,(R)}$	(3) AVERAGE SQ. FT. PER STUDENT STATION $\frac{\Sigma\,(f)}{\Sigma\,(a)}$	(4) AVERAGE STUDENTS PER CLASS SECTION $\frac{\Sigma\,(NP)}{\Sigma\,(P)}$	(5) AVERAGE PERIODS PER WEEK PER ROOM $\frac{\Sigma\,(P)}{\Sigma\,(R)}$	(6) AVERAGE PERCENT STATIONS OCCUPIED $\frac{\Sigma(NP).100}{\Sigma\,(Pa)}$	(7) AVERAGE STUDENT PERIODS PER STATIONS $\frac{\Sigma\,(NP)}{\Sigma\,(a)}$	(8) AVERAGE SQ. FT. PER 100 STUDENT PERIODS $\frac{\Sigma\,(f)}{\Sigma\,(NP)/100}$
1314	Variable Equipment Labs	22.9	1,523	66.5	21.7	9.9	72.1	9.4	707.9
1315	Drafting Rooms	25.5	1,144	44.9	15.4	32.5	58.1	19.6	229.3
Wtd. Avg. - Teaching Laboratories		28.3	1,286	45.4	22.7	10.6	76.0	8.5	534.6
All Other Special Purpose Instructional Space		18.7	1,053	56.2	12.0	8.5	51.5	5.4	1,034.0
GRAND TOTALS - All Scheduled Instruction		47.5	N.C.	N.C.	28.9	N.C.	N.C.	N.C.	338.3

* Σ is Sigma or sum; all averages are weighted, computed from the sums and sums of products for individual rooms.

N.C. = not computed; averages of these totals have no meaning.

measures probably understate the actual use.

The grand total averages have little meaning except to show that the overall weighted average class size at the University of Guelph is 28.9 students per section. This is in line with typical university averages.

In order to evaluate these utilization averages, the following comparisons may be made with published normative data:

3.4 Comparisons with Normative Utilization Data

A common reaction, when college and university classrooms are found to be utilized only 15 to 20 periods per week, is to wonder why they can't be scheduled at least 40 hours per week. Individual rooms can be, and frequently are, scheduled 40 and more hours per week, especially in urban institutions with large night programmes. However, it is almost impossible to have all classrooms average 40 hours per week of daytime use. The reason lies in the necessities of scheduling large numbers of students into a wide variety of courses required for degree work.

If an institution has a rigid prescribed curriculum, with little option or elective opportunities for the student to select from a wide variety of courses, much higher utilization could be achieved. But universities do not and should not have rigid prescribed curricula. The freedom of choice from among a diversity of opportunities, permits the student to build a unique educational programme suited to his individual needs and interests.

This is one of the valued characteristics of university education in the free world.

Nevertheless, the student must fulfill certain requirements prescribed for a given degree, and he must take certain kinds of courses at certain levels of his educational career in order to make timely progress toward his degree.

Because of the constraints of the complex student scheduling problem, it is very difficult to exceed an overall average daytime use greater than 30 periods per week in classrooms and 20 periods per week in teaching laboratories. As these levels are approached, scheduling conflicts increase.

Inefficiencies in faculty assignments also may develop from excessively tight room scheduling or when the room size distribution is too close a fit with the class size distribution. Some excess of room station capacity should always be allowed for so that class section sizes may be increased slightly beyond the expected level to avoid the necessity of setting up additional sections with consequent increase in instructor cost and decrease in average class size.

Generally, the larger the institution the greater is the classroom and teaching laboratory utilization capability. This is due to the ability of a large institution to offer more multi-section courses which in turn reduce the probabilities of scheduling conflicts between related courses in the student's programme. This proposition is suggested in the Doi-Scott compilation of utilization data from over 200 colleges and universities in the United States.

The median levels of average periods per week per room for small, medium and large degree-granting institutions were as follows:*

	Classrooms	Teaching Laboratories
Small Institutions	17.2	11.7
Medium Institutions	20.2	14.4
Large Institutions	23.8	16.5

Teaching laboratories and other special-purpose rooms have lower scheduling capacity for two reasons: (1) Laboratory sessions are scheduled in larger blocs of time (two, three and four periods per session, one or more times per week) and thus have greater problems of schedule conflicts. Laboratory sections frequently must be co-ordinated with lecture and recitation sections within the same course. (2) If special courses requiring specialized laboratory or other facilities are to be offered at all, the facilities must be provided regardless of the level of demand.

The larger the proportion of advanced level work, the larger the proportion of highly specialized courses and laboratories required. If laboratories are made too small, more sections may have to be taught than necessary as the institutions grow, perhaps at the cost of inefficient use of faculty time.

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* Doi and Scott, op. cit., Tables 1 and 2. Small institutions are those with 1,000 or fewer FTE; medium, 1,000 - 3,000; large, over 3,000.

In spite of these conditions, the University of Guelph in the fall of 1964 utilized its classrooms and teaching laboratories at far lower levels than comparable institutions for which data is available.

In all but one measure -- the station occupancy in teaching laboratories -- Guelph was far below the median rates of 47 medium-sized degree-granting institutions reported in the Doi-Scott study.

In Table 3.3 (p.40), the Guelph utilization indices are compared with the percentile ranking in the Doi-Scott normative data. More than 90 per cent of the institutions in the group used their classrooms more intensively in terms of scheduled periods per week; more than 80 per cent had better station occupancy.

In teaching laboratories, 80 per cent of the group of institutions of medium-size had higher rates of scheduled periods per week. To reiterate, the one departure from generally low utilization is in the percentage of stations occupied in teaching laboratories when in scheduled use: Guelph did better than three-quarters of the institutions in the comparison group.

In Table 3.4 (p.41), the Guelph utilization indices for the fall of 1964 are compared with the median rates for institutions in its size category. If the University

TABLE 3.3

COMPARISON OF
UNIVERSITY OF GUELPH INSTRUCTIONAL SPACE UTILIZATION, FALL 1964,
WITH DOI - SCOTT NORMATIVE DATA
FOR INSTITUTIONS BETWEEN 1,000 & 3,000 FTE

UTILIZATION MEASURES	CLASSROOMS		TEACHING LABORATORIES	
	GUELPH 1964	PERCENTILE RANK*	GUELPH 1964	PERCENTILE RANK*
Average Scheduled Periods Per Week Per Room	14.1	1st - 10th	10.6	20th
Average Percentage Of Stations Occupied When Rooms Were In Use	43.2	10th-20th	76.0	70th-80th
Average Student Periods Per Station (Actual) Per Week	6.7	1st - 10th	8.5	20th-30th
Average Assignable Square Ft. Per 100 Student Periods Of Occupancy	199.0	10th-20th	534.4	20th-30th

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* James I. Doi and Keith L. Scott, Normative Data on the Utilization of Instructional Space in Colleges and Universities, American Association of Collegiate Registrars and Admissions Officers, July, 1960. Levels used in Tables 1 - 8 for degree - granting institutions producing between 15,001 student credit hours and 45,000 s.c.h. (1,000 to 3,000 F.T.E.)

TABLE 3.4

NORMATIVE UTILIZATION RATES AT THE 50TH PERCENTILE (MEDIAN), DOI & SCOTT STUDY, 1959, COMPARED WITH ACTUAL RATES AT THE UNIVERSITY OF GUELPH, FALL 1964 INSTITUTIONS BETWEEN 1,000 & 3,000 FTE

	CLASSROOMS		TEACHING LABORATORIES	
MEASURE	NORMATIVE MEDIAN	GUELPH	NORMATIVE MEDIAN	GUELPH
Average No. Persons Per Week Per Room	17.2	14.1	11.7	10.6
Average No. Student Periods Per Station Per Week	9.1	6.7	6.8	8.5
% Stations Occupied When Rooms Were In Use	52.3	43.2	54.4	76.0
Assignable Square Ft. Per 100 Student Periods	171.3	199.0	497.5	534.6

had used its classrooms at even this median level, it could have scheduled its 1964 courses in 51 classrooms, lecture rooms, and seminar rooms instead of the 63 it used. Ten classrooms in the University stock were not scheduled at all.

At the median level of assignable square feet of classrooms per 100 student periods, Guelph would (theoretically) have saved nearly 13,000 square feet of space. These comparisons cannot be made for laboratories, which, in any case, more nearly approached the normative median.

The median levels, it may be noted, are substantially below the levels that can be achieved with carefully planning and systematic scheduling. The next question, then, is what levels of utilization should be planned for in the future?

3.5 Recommended Planning Goals For The Utilization Of Scheduled Instructional Facilities

As the University of Guelph develops over the next five years into a multi-purpose university with some 6,000 students, its scheduling capability will improve significantly, and the utilization of its instructional space can be substantially increased.

Growth, alone, will fill out the currently unused capacity in large part, and the greater diversity of class meeting types and sizes will permit fuller scheduling by diminishing the potential for schedule conflicts.

Furthermore, although they are not yet fully developed, computer scheduling techniques are in the offing that may further the ability of the institution to schedule its instructional facilities more intensively.

As new and better designed classrooms are built, tailored to the types and sizes of class meetings anticipated, and as the poorer and excessively large rooms are converted to other uses, the University should be able to double the utilization rates of its instructional facilities.

In Table 3.5 (p.46), the normative utilization levels at the 80th percentile for large institutions (over 3,000 FTE students) are listed from the Doi-Scott study. These suggest reasonable levels that the University of Guelph might expect to attain by 1970 with careful planning.

For planning purposes, to determine the numbers and sizes of rooms needed to serve the projected instructional programme over the next five years, the utilization criteria given in Table 3.6 (p.47) are recommended. Levels that may be attained by 1966 are given to aid schedule-building process outlined in Section 6. These call for the assignment of classroom time and space to achieve an average of 17 scheduled periods per week with at least 50 per cent of stations occupied on the average. These appear to be the levels of capability given the size and character of existing facilities and the anticipated levels of enrolment in the fall of 1966. Teaching laboratories should be used at least 12 periods per week on the average with

75 per cent of stations occupied (the current level).

By 1970, when the full impact of the Wellington College development will be in force and when the programme of construction and renovation should have produced a balanced distribution of room types and sizes, much higher levels of utilization can be achieved.

Classrooms can be programmed for at least 28 periods per week of average scheduling with an average station occupancy of 67 per cent. Teaching laboratories should be capable of averaging 20 scheduled periods per week with 80 per cent station occupancy.

The lower levels of laboratory use are to be expected because of the continued large proportion of highly specialized laboratories capable of only limited scheduling. Much higher scheduling should be expected in the laboratories serving the large multi-section basic science courses. Many of these should be programmed for utilization up to 30 periods per week if the 20-periods average is to be attained.

The application of these utilization criteria to the projected requirements of 1970 are shown in the following section.

TABLE 3.5

NORMATIVE UTILIZATION RATES AT THE 80TH PERCENTILE FOR INSTITUTIONS OF MORE THAN 3,000 STUDENTS

	CLASSROOMS	TEACHING LABORATORIES
Average No. of Periods Per Week Per Room	28.6	22.5
Average No. Of Students Periods Per Week Per Station	17.7	16.0
Per Cent Stations Occupied When Rooms Actually In Use	61.8%	74.7%
Assignable Square Ft. Per 100 Periods Of Student Occupancy Per Week	84.7	257.3

Source: James I. Doi and Keith L. Scott, Normative Data on the Utilization of Instructional Space in Colleges and Universities, American Association of Collegiate Registrars and Admissions Officers, 1960. These are for degree-granting institutions producing 45,000 student credit hours or more in the fall term in which the utilization studies were conducted, between 1956 and 1959. The 80th percentile level means that 80 per cent of the institutions in the survey group had lower utilization rates, 20 per cent were higher. For the various measures, the number of institutions in this size group ranged between 25 and 32.

TABLE 3.6

RECOMMENDED UTILIZATION PLANNING GOALS FOR CLASSROOMS AND TEACHING LABORATORIES AT THE UNIVERSITY OF GUELPH

1966 AND 1970

	OVERALL AVERAGES DAYTIME SCHEDULING			
	CLASSROOMS		TEACHING LABORATORIES	
	1966	1970	1966	1970
Average Periods Per Week Per Room	17.0	28.0	12.0	20.0
Average Per Cent Stations Occupied When Room In Use	50%	67%	80%	80%

SPECIFIC LEVELS FOR TEACHING LABORATORIES

General teaching laboratories for courses generating at least 10 laboratory sections:	30 periods per week
Specialized or advanced laboratories for courses generating between three and ten sections:	20 periods per week
Minimum level of scheduled use for specialized teaching laboratories:	6 periods per week*

* Teaching laboratories for courses generating less than 6 periods per week should be combined with other courses requiring similar facilities when possible or designed for graduate research use when not scheduled for specific courses.

SECTION 4

POSSIBLE STRATEGIES FOR MEETING PROJECTED INSTRUCTIONAL SPACE NEEDS AND IMPROVING THE UTILIZATION OF ALL TEACHING SPACES

4.1 General Alternatives

It is possible for the University to meet its 1970 scheduled instructional needs by intensively using its stock of existing space and by carrying out a modest construction programme for a limited amount of badly needed space.

Undeniably in this strategy utilization rates would improve without any special action on the part of the University. This strategy could be followed for at least the next three years at Guelph provided that classes are scheduled intensively six days a week.

This alternative of course only postpones the replacement of obsolete space. It would be difficult to group related teaching spaces by department. There would be no identifiable beginning point for Wellington College. The quality of the teaching programme might be impaired by forcing course sizes into awkward spaces. For example, a small seminar might have to be time-tabled into a 100 seat lecture hall -- an obvious waste of space.

We do not recommend this strategem, but make note of it to confirm the fact that increased enrolments in all academic units, including Wellington College, might be accommodated for the next several years with only slight changes in existing inventory.

At the other end of the spectrum of possibilities is the strategy of constructing new space for increasing enrolments with no attempt at better utilization of existing or new space. This would be an extravagant measure for a public institution faced with heavy obligations to develop supporting faculties for an ever enlarging university.

The reasonable strategy of course lies between these two extremes and would consist of a combination of these measures:

a. The application of normative utilization standards to both the existing stock that remains in use and the new construction. Recommendations for these actions are described in Section 6, Improving Utilization Through Space Programming and Space Scheduling.

b. The construction of new space with special emphasis on those facilities which are not in the present stock.

c. Undertaking qualitative changes in the existing stock of assignable teaching spaces and the gradual elimination of teaching spaces which are obsolete and which are unlikely to be effectively scheduled at optimum utilization rates, i.e. a space renewal programme.

4.2 Renewal Programmes

Three kinds of renewal actions are envisioned:

Rehabilitation Painting, resurfacing of floors, placing acoustical tile. Rehabilitation costs would run from $2.50 to $6.00 a square foot. These costs would be warranted in any building having a longevity of two or more years.

Modernization This would include rehabilitation plus improvement in lighting and electrical outlets, minor partitioning, the addition of new furniture, shelving, and such items as blackboards, tackspace, etc. Modernization costs would run about $10.00 a square foot. These actions would be warranted in any building having a longevity of five or more years.

Reconstruction This would include all the above plus structural changes and additions. Costs would be close to that of new construction and warranted only if the space created or changed had a life expectancy of a decade or more.

In identifying which buildings should be subject to renewal three factors need to be weighed: priority of need, staging, and location.

4.3 Priority of Need

Obviously the first investment in renewal should be made in those buildings and rooms which will meet the immediate academic requirements and at the same time afford the highest utilization rates.

Column 10, Table 5.1, page 61 identifies those rooms which are likely to receive heavy use in 1970. The table also shows the station size, existing and expected utilization. The latter information was derived from 1970 projections made by the individual department heads.

4.4 Staging

We have already indicated that investments in renewal actions should be considered in light of the possible longevity of the buildings involved.

This is important because some buildings are scheduled for demolition in the long-range plan in order to provide sites for new construction. Other buildings have inherent structural deficiencies which obviate alteration and modernization. Other buildings are obsolete because of age and building materials and do not warrant any further investment in renewal. Some buildings will only serve for short-term assignments while equivalent space is being constructed elsewhere and hence should not be considered part of the long-range stock.

Accordingly the various buildings now used for teaching can be grouped this way:

1. Buildings in which renewal action is not warranted because of (a) age, (b) obsolescence, and (c) because they also occupy

key sites for early new construction:

Building 12	Chemistry
Building 13	Chemistry Annex
Building 23	Extension Education

2. Buildings in which renewal action is not warranted because of (a) age, (b) condition, and (c) materials of building construction:

Building 6	Microbiology
Building 41	OVC Laboratory Building

3. Buildings in which renewal is not warranted because of (a) age, (b) condition, (c) materials of construction, (d) the space therein is obsolete and being replaced in scheduled new construction, and (e) because existing teaching spaces do not lend themselves to conversion to other teaching uses at reasonable costs:

Building 33	OAC Meat Laboratory
Building 34	OAC Nutrition Laboratory
Building 52	Beef Barns

4. Buildings in which renewal should be limited to rehabilitation because of (a) age, (b) obsolesence of exterior and interior, and (c) because they occupy key sites for future new construction:

Building 15	Engineering Annex
Building 16	Animal Husbandry
Building 20	Apiculture

5. Buildings in which renewal actions should be limited to interior changes, largely modernization; in anticipation that they they will be removed in the latter stages of the long-range development plan because of age, condition and/or because they occupy key sites for new construction:

Building 21	Field Husbandry
Building 59	Trent Institute
Building 30	Refrigerator Storage Building
Building 29	Greenhouses

6. Buildings in which renewal actions should be limited to interior changes because of location and objectives of the long-range plan.

Building 28	Horticulture

7. Buildings which lend themselves to a full range of renewal actions. These are listed in order of susceptibility for change to meet the urgent teaching needs:

Building 25	Economics
Building 26	Physics
Building 32	Graham Hall

8. Buildings in which renewal action cannot be specified until building has been evaluated architecturally as to range of costs for renewal actions:

Building 14	Agricultural Engineering
Building 17	Judging Pavilion
Building 24	Massey Hall

9. Buildings in which renewal actions cannot be fairly determined until academic programmes and building needs have been detailed further:

Building 1	Macdonald Institute

All other buildings used for teaching purposes in Fall 1964 are susceptible to the full range of renewal actions if warranted because of academic programmes, for there are no impediments in terms of building longevity and long range site position. These buildings are:

Building 18	Soils
Building 31	Biology
Building 38	Dairy Buildings
Building 39	OVC Main Building
Building 40	OVC Extension
Building 44	OVC Surgical Wing
Building 46	Poultry Pathology
Building 50	Physical Education

4.5 Location

One of the objectives of the long-range development plan has been to place as many teaching buildings as possible within a ten minute walking distance zone, so as to encourage maximum utilization of all teaching spaces. Certain existing teaching buildings however will be on the edge of the ten minute walking zone and accordingly will not afford maximum utilization. Listed in order of proximity to the centre of the major instructional areas the existing teaching buildings in this category (edge of maximum utilization zone) are:

Building 32	Graham Hall
Building 33	Meat Laboratory
Building 37	Dairy Barn
Building 39	OVC Main Building
Building 40	OVC Extension
Building 1	Macdonald Institute
Building 44	OVC Surgical Wing
Building 46	Poultry Pathology

4.6 Evaluation

The three considerations - priority of need, staging and location - have guided us in determining how each classroom in each teaching building might be better utilized. These matters are covered in the next section.

SECTION 5

RECOMMENDED ACTIONS FOR IMPROVING THE UTILIZATION OF EXISTING STOCK

5.1 Definition Of Existing Stock

Existing stock referred to in this section is the Fall 1964 building inventory. Allowances have been made for spaces removed by 1970 because of obsolescence or other reasons listed in the previous section.

The stock remaining by 1970 is assumed to be capable of better utilization. New facilities are programmed on the basis of optimum utilization rates, so that gains there would be minimal.

5.2 Types Of Improvements

For the existing stock there are two actions which can be taken to improve utilization rates: better scheduling so that maximum opportunity is afforded for use, and qualitative physical changes in the interior environment so as to encourage higher utilization.

Section 6 outlines a recommended space programming and space scheduling system. This section deals with physical changes and utilization expectations, room by room.

5.3 Coding Recommendations

The spaces most susceptible to improvement are the classrooms. These may be continued in use or changed into other uses. Many classrooms continuing in use warrant rehabilitation and modernization.

In Table 5.1 we have listed all the classrooms inventoried in the Fall 1964 and evaluated their potential for change. Each classroom is rated so as to indicate areas where architectural studies might proceed with the purpose of carrying out the designated actions.

Each classroom is described as follows:

1. Building Number
2. Building Code Name
3. Room Number
4. Age Of Building
5. Area -- Assignable Square Footage
6. Number Of Student Stations -- Actual Fall 1965
7. Utilization By Periods Per Week -- Fall 1964
8. % Student Stations Occupied -- Fall 1964
9. Location Rating
10. Size Rating
11. Quality Rating
12. Utilization Expectations
13. Recommended Use
14. Renewal Action

Items 1 to 8 above were taken from the basic utilization data gathered in the Fall 1964.

The ratings given in columns 10 to 12 were established in the following way:

Location: Spaces were rated on the basis of how close they will be the centre point of daytime student population for maximum utilization. This point is near the proposed site for the new library. A three category rating was established:

- A -- Prime location for maximum utilization
- B -- Good location for optimum utilization
- C -- Not well located for improved utilization

Size: Spaces were rated on the basis of whether or not they would be likely to receive higher or lower use because of the room size. Owing to the class-section structure some types of rooms are likely to be in heavier demand than others. Again a three point category was used.

- A -- Falls into heavy use category
- B -- Falls into medium use category
- C -- Not in category 1 or 2

Environmental Conditions: As part of the reconnaissance studies the Consultants examined the environmental quality of a major number of teaching classrooms in the summer 1964.

The following physical conditions were recorded and evaluated:

Condition Of Surfaces
Lighting - Quality
Acoustical Treatment - Quality
Ventilation - Quality
Basic Teaching Funishings - Quality

    - Seating Arrangements
    - Chalkboards
    - Tackspace
    - Audio-visual Equipment
- Fire Sensing Equipment
- Environmental Conditions - Exterior and Interior
    - Noise
    - Odours
    - General Amenity
- Circulation Patterns - Interior

We have called the objective/evaluation of the sum of the above the environmental quality of the rooms.

The purpose of the study was to expose areas where upgrading of teaching facilities might take place, since general obsolescence is a typical condition in many universities. In conjunction with the space utilization data we are thus able to suggest areas which deserve priority attention.

Accordingly, the environmental factors are also coded on a three point system:

A -- Good
B -- Fair
C -- Poor

Column 12, Utilization Expected, is the Consultants subjective evaluation based on location, size and quality of the individual room.

Column 13, Use, suggests how the rooms should be used in the future, e.g. continued in use convert, remove, etc.

Column 14, Renew Action, sums up the potential for remedial action based on utilization studies. A three point code system is used.

A -- Spaces where modernization is warranted
B -- Spaces where rehabilitation is warranted
C -- Lowest priority for remedial action

Code A are those spaces which are considered to have the highest priority for remedial action for purposes of improved utilization. Architectural studies should proceed here immediately.

Other remedial actions might take place simply because the quality of the spaces is poor or the spaces inadequate for their functions, however these cases need to be judged on an individual basis. The code system suggests where these reviews might take place.

Several buildings were undergoing renovation, change, and design study while the basic inventory data was being evaluated. Thus the information relating to these buildings is not completely covered. These buildings are:

Field Husbandry
Agricultural Engineering
Physics
War Memorial Hall

5.4 Laboratories

Because of their specialized nature it has not been possible to apply the classroom qualitative evaluations to laboratory spaces. The utilization studies indicate that significant improvements can be made in scheduling of these areas. We thus suggest that the University take the following actions with reference to teaching laboratories:

1. Carefully scrutinize departmental requests for new teaching laboratory space so as to determine whether or not such requests are made on the basis of optimal utilization standards.
2. Encourage the development of multiple-use laboratories for beginning courses in the sciences.
3. Examine the possibility of converting research laboratories in central campus locations into basic teaching laboratories.
4. Establish a semi-annual inventory review of laboratory use to seek out areas where qualitative changes might be carried out in anticipation of better utilization. In this respect the University staff should establish environmental criteria comparable with those used in our review of the classrooms.

5.5 Offices

Offices are in short supply; underutilization is not a problem. Environmental conditions vary from building to building. A uniform space assignment procedure should be established for office space, and a systematic upgrading of the interior conditions be carried out. At a minimum each office should have: a desk, chair, visitor's chair, bookshelving, adequate lighting.

TABLE 5.1

ACTIONS FOR IMPROVING UTILIZATION OF EXISTING CLASSROOM STOCK

BLDG. NO.	BLDG.	ROOM NO.	AGE OF BLDG.	FLOOR AREA A.S.F.	ACTUAL NO. STUDENT STATIONS	FALL 1964 PERIODS PER WEEK	FALL 1964 % STATIONS OCCUPIED	RATING			UTILIZATION EXPECTATIONS	USE	RENEWAL ACTION
								LOCATION	SIZE	QUALITY			
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	MAC 1	103	1903	750	84	18	66.6	C	A	B	Medium	Continue	C
1	MAC 1	106	1903	875	75	17	65.3	C	A	B	Medium	Continue	C
1	MAC 1	133	1903	864	60	12	34.5	C	A	B	Low	Continue	C
1	MAC 1	101	1903	529	20	2	30.0	C	A	A	Medium	Continue	C
1	MAC 1	15B	1903	1,178	105	7	42.2	C	B	A	Medium	Continue	C
6	MICB	217	1944	1,275	130	12	31.3	REMOVE - OBSOLETE (FRAME BUILDING)					
12	CHEM	201	1896	1,170	108	7	19.0	REMOVE - OBSOLETE					
12	CHEM	206	1896	1,750	150	12	23.7	REMOVE - OBSOLETE					
13	CEMA	112	1946	1,740	120	7	43.6	REMOVE - OBSOLETE (FRAME BUILDING)					
14	AGEN	018	1906	400	30	NOT SCHEDULED TO BE STUDIED ARCHITECTURALLY FOR CHANGE							
14	AGEN	114	1906	1,224	78	9	24.5	A	A	C	High	Continue	A
14	AGEN	124	1906	336	20	NOT SCHEDULED		A	A	B	REVIEW FUTURE USE		
14	AGEN	213	1906	672	60	REVIEW		A	A	C	High	Continue	A

.... Continued

TABLE 5.1 (CONTINUED)

BLDG. NO.	BLDG.	ROOM NO.	AGE OF BLDG.	FLOOR AREA A.S.F.	ACTUAL NO. STUDENT STATIONS	FALL 1964 PERIODS PER WEEK	FALL 1964 % STATIONS OCCUPIED	RATING			UTILIZATION		RENEWAL ACTION
								LOCATION	SIZE	QUALITY	EXPECTATIONS	USE	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
14	AGEN	105	1906	360	20	2	10.0	A	A	B	High	Continue	B
14	AGEN	11	1906	1,225	40	15	30.0	A	C	B	DEP. ON CONVERSION USE	STUDY ARCHITECTUALLY	
16	AHUB	104	1895	1,176	48	5	32.2	REMOVE	-	OBSOLETE			
16	AHUB	214	1895	1,296	62	15	57.4	REMOVE	-	OBSOLETE			
16	AHUB	210	1895	312	10	13	36.2	REMOVE	-	OBSOLETE			
18	SO1B	102	1959	392	28	14	40.6	A	A	A	High	Continue	C
18	SO1B	122	1959	1,530	65	NOT SCHEDULED		A	A	A	High	Continue	C
18	SO1B	224	1959	1,530	154	17	43.9	A	C	A	Medium	Continue	C
21	FHUB	122	1913	1,500	60	17	56.5	A	A	B	*	*	*
21	FHUB	123	1913	1,060	64	18	49.9	A	A	C	*	*	*
21	FHUB	206	1913	4,200	300	11	42.6	A	A	C	*	*	*
21	FHUB	208	1913	1,332	108	7	71.4	A	C	B	*	*	*
					* BUILDING NOW BEING REDESIGNED FOR WELLINGTON COLLEGE.								
23	EXED	102	1892	840	110	8	53.9	REMOVE	-	OBSOLETE			

.... Continued

TABLE 5.1 (CONTINUED)

BLDG. NO.	BLDG.	ROOM NO.	AGE OF BLDG.	FLOOR AREA A.S.F.	ACTUAL NO. STUDENT STATIONS	FALL 1964 PERIODS PER WEEK	FALL 1964 % STATIONS OCCUPIED	RATING			UTILIZATION EXPECTATIONS	USE	RENEWAL ACTION
								LOCATION	SIZE	QUALITY			
1	2	3	4	5	6	7	8	9	10	11	12	13	14
23	EXED	221	1892	961	82	20	49.9	REMOVE	-	OBSOLETE			
23	EXED	222	1892	375	30	2	40.0	REMOVE	-	OBSOLETE			
23	EXED	101	1892	961	100	NOT SCHEDULED		REMOVE	-	OBSOLETE			
23	EXED	101A	1892	576	36	NOT SCHEDULED		REMOVE	-	OBSOLETE			
24	MASH	101	1893	2,436	169	21	23.0	A	C	B	High	Continue	C
25	ECON	101	1901	1,440	165	14	40.0	A	C	B	High	Convert	A
25	ECON	104	1901	900	70	17	68.2	A	A	B	High	Continue	B
25	ECON	300	1901	460	46	11	39.1	A	A	C	High	Continue	A
25	ECON	302	1901	420	43	26	45.8	A	A	B	High	Continue	B
25	ECON	311	1901	522	36	16	27.4	A	A	B	High	Continue	B
26	PHYS	202	1916	1,591	56	17	63.7	A	A	BUILDING UNDER RENOVATION			
26	PHYS	210	1916	1,620	187	13	66.3	A	C	BUILDING UNDER RENOVATION			
26	PHYS	305	1916	814	24	21	90.5	A	A	BUILDING UNDER RENOVATION			
28	HORT	124	1930	644	30	13	25.1	A	A	B	High	Continue	B
28	HORT	130	1930	2,120	162	1	100.0	A	C	C	High	Convert	A

.... Continued

TABLE 5.1 (CONTINUED)

								RATING					
BLDG. NO.	BLDG.	ROOM NO.	AGE OF BLDG.	FLOOR AREA A.S.F.	ACTUAL NO. STUDENT STATIONS	FALL 1964 PERIODS PER WEEK	FALL 1964 % STATIONS OCCUPIED	LOCATION	SIZE	QUALITY	UTILIZATION EXPECTATIONS	USE	RENEWAL ACTION
1	2	3	4	5	6	7	8	9	10	11	12	13	14
28	HORT	233	1930	506	9	15	92.6	A	A	A	High	Continue	C
28	HORT	236	1930	690	60	18	13.9	A	A	C	High	Continue	A
31	BIOL	149	1961	2,109	184	20	41.3	A	C	BUILDING JUST OPENED			
31	BIOL	178	1961	616	59	5	12.2	A	A	BUILDING JUST OPENED			
31	BIOL	228	1961	682	59	14	28.8	A	A	BUILDING JUST OPENED			
31	BIOL	230	1961	3,249	375	20	57.0	A	A	BUILDING JUST OPENED			
31	BIOL	329	1961	616	59	10	41.0	A	A	BUILDING JUST OPENED			
31	BIOL	114	1961	405	15	8	65.0	A	A	BUILDING JUST OPENED			
31	BIOL	245	1961	150	6	4	41.7	A	C	BUILDING JUST OPENED			
32	GRAH	201	1914	600	24	2	10.0	B	A	B	Medium	Continue	B
32	GRAH	202	1914	378	10	9	47.7	B	C	B	High	Convert	A
32	GRAH	101	1914	1,160	108	5	39.8	B	B	C	High	Convert	A
32	GRAH	211	1914	1,764	143	7	35.5	B	C	C	High	Convert	A
33	MEAT	106	1924	1,815	151	4	29.8	REMOVE	-	OBSOLETE			
34	NUTR	208	1893	150	8	2	50.0	REMOVE	-	OBSOLETE			

.... Continued

TABLE 5.1 (CONTINUED)

BLDG. NO.	BLDG.	ROOM NO.	AGE OF BLDG.	FLOOR AREA A.S.F.	ACTUAL NO. STUDENT STATIONS	FALL 1964 PERIODS PER WEEK	FALL 1964 % STATIONS OCCUPIED	RATING LOCATION	SIZE	QUALITY	UTILIZATION EXPECTATIONS	USE	RENEWAL ACTION
1	2	3	4	5	6	7	8	9	10	11	12	13	14
38	DYBG	204	1921	1,344	130	5	23.5	A	C	C	High	Convert	A
38	DYBG	205	1921	960	32	19	23.1	A	C	C	High	Convert	A
38	DYBG	101	1921	288	10	NOT SCHEDULED		A	C	REVIEW POSSIBLE USE			
39	VCMB	107B	1922	1,200	115	16	70.9	A	A	C	High	Continue	A
39	VCMB	14	1922	1,302	127	19	65.0	A	A	B	High	Continue	Study
40	VCEX	15	1942	1,050	76	NOT SCHEDULED		A	REVIEW USE				
44	VCSW	508	1963	1,480	125	12	51.2	A	A	A	High	Continue	C
44	VCSW	510	1963	1,369	82	19	62.2	A	A	A	High	Continue	C
50	PHYE	115	1958	735	35	NOT SCHEDULED		A	A	A	High	Continue	C
9	WARH	103	1924	5,335	833	NOT SCHEDULED		A	A	BEING STUDIED FOR RENOVATION			
27	CHMI	164G	1964	1,316	140	NOT SCHEDULED		BUILDING JUST OPENED					
27	CHMI	211	1964	1,316	140	NOT SCHEDULED		BUILDING JUST OPENED					
27	CHMI	253	1964	812	70	NOT SCHEDULED		"	"	"	"	"	"
27	CHMI	254	1964	504	36	NOT SCHEDULED		"	"	"	"	"	"
27	CHMI	310	1964	532	33	NOT SCHEDULED		"	"	"	"	"	"
27	CHMI	232	1964	3,300	300	NOT SCHEDULED		"	"	"	"	"	"

SECTION 6

IMPROVING UTILIZATION THROUGH SPACE PROGRAMMING AND SPACE SCHEDULING

6.1 Purpose and Limitations

While studying the present utilization of space and the future building requirements the Consultants have collected the critical data, devised techniques for evaluating the important facts, and developed forms and procedures that are appropriate to the University of Guelph's special characteristics.

We recommend that these materials be used as the basis for a continuing system of space programming and space scheduling. Accordingly we show in this section a method by which the University can carry out such studies with its own staff.

The technique outlined is a system for scheduling teaching space that includes the prediction in broad form of the kinds and amounts of teaching spaces required in future years. As shall be apparent in the following discussion, a number of other advanced planning procedures concerning staffing, academic planning, building programming, maintenance scheduling, capital budgeting and cost accounting can be developed as extensions of the recommendations. For these reasons, it is important that the persons involved should be familiar not only with the techniques described, but also with institutional administration and customs in general. Only in this way can the full worth of these studies be realized.

The procedures described below are based on the experience of the Consultants at other universities and at the University of Guelph in particular. While reasonably complete they should, however, be seen as guidelines for those responsible for implementing a system at Guelph. The professional skills of the individuals in charge of the system, changing conditions at the University as it grows, the type of data processing equipment available and the manner in which the procedures are tied into the planning process, are all factors which might change the details of the system, if not the general outline itself.

6.2 Basic Data

The Consultants have collected and placed on punched cards two basic sets of data for use in the system.

1. Basic inventory data - this consists of a set of punched cards produced from Form A[1].

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[1] In this description, the following conventions are used:

a.	Forms.	By this is meant any document meant to be filled by hand.
b.	Cards.	Punched cards of 80 columns, usually related to a form of the same number. e.g., Form A results in Cards A.
c.	Lists.	Lists refer to printouts from cards and/or other data processing equipment. Lists are usually designated with reference to the cards from which they were made. e.g., List A results from Cards A which came from Form A.

Each card represents a separate identifiable space within a building which existed on the campus in the Fall, 1964, and records a variety of descriptive data as well as space for other data to be added in the future as required.

The limitations of the data are as follows: the University does not now have a systematic building and room numbering system. Some spaces could not be defined with complete accuracy due to the lack of a person completely familiar with the physical plant. Some of the uses and details have changed since the Fall of 1964 because of renovations carried out since the inventory was made and because of changes of room assignment. These limitations are not serious, but the cards should accordingly be revised by the University as time goes on.

From this inventory list, continuously updated, the assignment of space to the various academic, research and administrative groups will be made. Some spaces will be allocated on a more or less permanent basis. Other spaces, such as classrooms and teaching laboratories, will not only be shared by various departments, but usually will be re-assigned from term to term. A copy of the current inventory listing has been supplied to the University.

2. Current academic programmes - University personnel were asked to list on Form C-2 the courses taught during the fall term of 1964. These data have been punched on cards and together with the inventory data provide the basic materials for a class scheduling system.

6.3 Technique for Allocating Teaching Spaces

The technique proposed uses a centralized space assignment office but allows detailed decisions to be made at the departmental level.

It will help the reader understand the descriptions if he first reviews the major steps listed below and then follows the flow diagram while reading the text, and refers to the sample forms and examples at the appropriate moment.

The major steps in the system are:

A. Space Assignment Officer (SAO) distributes to the Department Head in April the course list from the previous fall.

B. Department Heads revise course list and estimate next fall's enrolments and other data.

C. Space Assignment Officer reviews and checks lists for accuracy.

D. Space needs are calculated from summary of all Departmental needs in accordance with University utilization goals.

E. Initial block assignment of rooms is made to Departments on an established priority basis.

F. Departments assign courses within the block of space allocated, and the assignment sheets are returned to SAO.

These cards and lists are in the University's hands.

G. All detailed departmental assignments are checked by SAO for accuracy and any inter-departmental conflicts are resolved.

H. Time table is printed.

I. Students register.

J. Registration lists become basis for next year's step A.

The flow chart (Figure 6.1, p. 89) outlines in greater detail the various steps in the system. The circled numbers in the diagram are referred to in the text as D1, D2, D3, etc.

There are three principle forms, cards and lists described in the text.

1. A - Cards, lists and forms. The basic inventory of existing spaces at the University. These remain in the hands of the SAO.
2. C-2 Cards, lists and forms. This is the complete list of courses taught or to be taught for a given term. It includes data for each section of every type for every course and the time and place of those meetings.
3. C-4 Cards, lists and forms. This is the generalized information for every section type of every course.

In general, the merged decks of completed C-2 and C-4 cards for a given term provides:

1. All the information concerning academic programmes for that term necessary for the system;
2. Input for the forms which will be sent to the departments for the subsequent term's scheduling.

For purposes of illustration, let us begin the description of the system with the activities of the Space Assignment Officer (SAO) in Spring of 1965.

(D1) Taking the punched cards representing the academic programme of the University for Fall, 1964 (see Example 6.1, p. 86), he lists the various courses.

(D2) The SAO sends these lists to the appropriate department heads along with an instruction manual and blank copies of Form C-4. (see Example 6.2, p. 87).

Thus, each department head will be in possession of a list of the courses taught by his department in the previous fall term and forms for listing the programme he expects to teach in the Fall of 1965. The department heads should receive these forms sometime in April.

(D3) The department head fills out the Form C-4 as appropriate in Fields 1 through 12. The rest of the fields are used for subsequent purposes. He notes the addition or deletion of courses as well as those to be continued. In future years, the C-4 form will be prefilled in part before it is sent to the departments.

Example 6.2, p. 87 shows a completed form. Note that whereas C-2 (Example 6.1, p. 86) listed every section of every section type, only the section type is required for C-4.

In Example 6.2 Chem. 101 is expected to increase from 100 to 150 students, or by a factor of 1.50. Chem. 523 will not be taught in 1965 which fact is noted in Fields 8 and 9. Similarly, a new course Chem. 525 will be added to the programme.

(D4) Assuming that these were all the courses to be taught by the department head's group, the form would then be returned to the SAO. The SAO then takes all the C-4 forms from the various departments and carefully checks them for logical and clerical errors or omissions before having them keypunched. It is vital that the punched cards be an accurate representation of the academic programme. Furthermore, checking will rapidly increase the familiarity of the SAO with the structure and content of the academic programme data.

(D5) The data are then keypunched.

(D6) The calculations listed below are computed for each card:

a. $(E_1/M)(P)(T)$ the number of student section meeting periods per week where E_1 is the estimated course enrolment for the Fall 1965;

M is the optimum number of students per section;

P is the number of periods expressed to the nearest half hour that the section type meets each time it meets;

T is the number of meetings of that section each week.

The result is therefore the number of section meeting periods that must be physically accommodated in a week. For example, (Example 6.2, p. 87) Chem. 101 has a recitation or small quiz section that meets once a week for an hour. $(P=1.0)$, $(T=1)$. The desired size for that class is 25. $(M=25)$ The estimated total number of students expected to enrol in that course in the Fall, 1965, is 150. $(E_1=150)$ Therefore $(E_1/M)(P)(T) = (150/25)(1.0)(1) = 6.0$. In other words, sufficient numbers of classrooms must be provided to accommodate 25 students in 6 meetings per week. This does not mean that 6 classrooms must be provided. The calculation for the number of classrooms follows.

b. R (the required number of rooms) = $(E_1/M)(P)(T)/U$ where $(E_1/M)(P)(T)$ is as above;

U is the utilization factor established as University policy.

The utilization rate is discussed at some length elsewhere in this report. (see Section 2.4) For the moment, let us assume a factor of 28. That is to say, the University has established the policy that all classroom space will be utilized on the average 28 hours per week. Thus in Example 6.2, p. 87 for Chem. 101 recitation R = 0.2.

This means that according to University policy and the data supplied by the department heads 0.2 classrooms should suffice to supply all the space needs for the recitation section of Chem. 101. Experience has shown that rounding R to the nearest unit when R is greater than 1 does not materially lower utilization rates nor place undue strain on the scheduling system. If R is less than 1, it should be expressed as a decimal fraction.

(D8) The output of the processing step consists of:

1. Prefilled C-2 lists,
2. SAO allocation list,
3. Merged C-2, C-4 cards. (The C-4 as a header card, with a C-2 trailer card for each section.)

The content of (1.) above is as indicated in Example 6.1, p. 86. At this stage fields 7 - 11 will be blank.

The allocation list is simply an abbreviated version of List C-2 with the various calculations included. Sorted by department, course, room type and section size it will enable the SAO to perform his sequence and allocation decisions.

(D7) The SAO then takes his inventory listing sorted by room type and size and selects R teaching spaces of appropriate size, type and location from his inventory. He will base his selection on his knowledge of the requirements of the department and the existing available space. Needless to say, this knowledge will improve as the SAO gains experience.

(D9) He sends the appropriate Lists C-2 to the various department heads with the list of spaces allotted to each. In addition he sends copies of Forms C-3 which are simply worksheets with cells for each period during the week. (see Example 6.3, p. 88).

In selecting the appropriate size room the SAO should bear in mind that the cost of having a small percentage of seats empty is less than the cost of adding a section should that class be full. A new section requires an additional instructor.

The SAO should also encourage discussions among department heads relative to optimum section sizes. For example, if the department chooses section sizes of 60 in multiple sections, it might be that 65 seat classrooms are unavailable, but 100 seat classes abound. A change in optimum section sizes might therefore be desirable.

In order to assure maximum flexibility and ease, the SAO should send the forms and room blocks to the department heads in some order based on the observations which follow.

Departments which must have specific

special rooms should receive their forms first. Then those departments which have single sections of courses should be allowed to fill out their forms and should be instructed to schedule those sections on a regular basis. For example, if Latin is only taught in one lecture section three times a week, it should be scheduled before multiple section courses, and should meet at the same time on the three days. As we shall see, this allows ease of entrance to courses which have only one meeting.

When these courses have been scheduled, the SAO then crosses out their meeting times on the C-3 forms he sends to the departments having multiple section meetings. As may be observed, courses which meet in various sections at various times will be easier of entrance for the student than those that have only one section.

Courses which meet for 1½ hours at a time should be scheduled only at specific times. 11:00 - 12:30 and 4:00 - 5:30 are good first choices.

As time goes on, the sequence by which the SAO sends out the forms can be made more or less elaborate. This depends on the structure of the academic programme and the increasing knowledge of the SAO.

(D9) Using the forms and data provided, the department head fills out the worksheets for assignment of the various sections his department will teach. The department head must not use more than the R rooms he has been assigned. It will be noted that a given department head will typically receive a block of part or all of a number of rooms with which to fulfill the requirements of his department's teaching load. As we shall see, this is one of the great strengths of the system.

Two criteria should form the basis on which the department head assigns the various class sections. First, he should use his knowledge of the typical course structure of the students taking courses in his department to avoid as many potential conflicts as possible. Second, he should use his knowledge of the requirements of his faculty members to avoid unduly inconveniencing them. For example, a given professor may have a research programme which requires his attention during specific times of the week.

(D10) Having completed the List C-2 the department head returns them to the SAO who, having checked them for logic and clerical accuracy, completes the punching of the C-2, C-4 cards.

(D11) He then sorts the cards by building and room, days of the week and start times and examines the resultant list for schedule conflicts. C-2 lists are returned to the department heads for correction should conflicts occur. This cycle is continued until no conflicts appear.

Sorted again, this deck of C-2, C-4 cards then becomes the source of the printed time table. This time table is typically printed by a multilith process some months before the beginning of the term.

(D11A) A few weeks before the beginning of the term, the SAO should send out a notice to the various department heads asking them to inform him of any last-minute schedule changes.

(D12, 13, 14) The C-2, C-4 cards are updated with this information and a schedule supplement is issued.

(D15) The sequence for the registration process is illustrative rather than detailed, and is predicated on the "supermarket" technique. Its inclusion here is for didactic purposes rather than as an actual suggestion.

(D16) The student picks up a roll card for each course he plans to take. At the completion of his registration, the cards are all punched with his personal data, sorted and processed to produce the section roll and grade check list. These are sent to the instructor after all the adding and dropping of courses has been completed along with a correction card. The list is used by the instructor for his own roll and grading purposes, the card is filled out with the instructors name and the final time and place data and returned to the SAO.

(D17) These cards are then sorted and

merged with the C-2, C-4 cards to produce the new cards for the Fall 1966 scheduling cycle. A C-4 list for 1966 is produced.

In addition to providing current scheduling data, the completed cards are the basis for utilization studies, cost accounting systems, and building projection techniques. Some of these techniques have been performed by the consultants and are described elsewhere in this report. Other possible analyses are numerous and ought to be investigated by the University as time goes on. In particular, however, it should be stressed that the data on the final C-4 cards together with the updated inventory cards (Card A) are the basis for a rather complete and detailed unit cost accounting system when combined with existing data from the comptroller's office.

6.4 Projection Technique

The projection technique for future space requirements may be applied every five years or in any sequence required to coincide with building and budgeting schedules. In the year that the projection is required the SAO simply asks the department heads to fill in the projection data along with the regular scheduling data on Form C-4. (see Fields 13 to 17, Example 6.1, p. 86). In addition, any courses to be dropped or added by the projection data should be indicated. It should be noted that this projection technique in no way interferes with the regular scheduling activities. Sorting by section type, section size groupings and perhaps by locational or departmental criteria, the SAO then performs the following calculations:

$R_{tm} = (E_y/M)(P)(T)/U$ where

R is the number of rooms required,

t is the room type,

m is the optimum section size,

E is the enrolment projected for the section in question,

y is the projection year,

M is the optimum section size,

P is the number of periods per meeting,

T is the number of section meetings per week,

U is the utilization factor established as University policy.

As may be noted, this is essentially the same algorithm required for the allocation and scheduling of space for any given term. Added up and compared to the existing inventory of space, this projection technique provides a basis for future planning and development.

6.5 Other Studies

A number of other studies may be envisioned as coming forth from the basic scheduling and projection techniques suggested. A more complete system is beyond the scope of this paper, but given the inputs of:

1. student records (demographic, biographical and academic),
2. cost data,
3. academic programmes, and
4. existing inventory of space.

The following list of possible outputs is suggestive:

A. Analytical studies
   1. Instructional cost studies
      a. By subject
      b. By type of student
      c. By major programme
   2. Faculty work load studies
   3. Instruction programme demands and characteristics
   4. Instructional programme methods and experimentation
   5. Space utilization studies
   6. Student studies
      a. academic performance
      b. student characteristics

B. Planning studies
   1. Short-range forecasting
      a. Instructional schedule-building
         (1) Number of course sections
         (2) Staffing requirements

        - (3) Time allocations
        - (4) Space Assignments
    - b. Budget preparation
        - (1) Tuition income estimates
        - (2) Faculty requirements
        - (3) Staff requirements
        - (4) Supply and expense requirements
- 2. Long-range forecasting
    - a. Policy development
    - b. Programme development
    - c. Operating budget requirements
    - d. Five-year moving capital budget programme
    - e. Campus development plan programme

The following digression may serve as an example. If we take the algorithms for R_{tm} the number of Rooms (R) of type (t) and size (m) and $E_y = f(L_y)$ where E is the course enrolment in year (y) and L is the projected total university enrolment arrived at by some predictive technique (or perhaps government fiat) for year (y) we have the basis of a simulation model. We can predict R_{tm} for a variety of E_y, L_y, T, M, P, T and U, for y year(s).

If we add to this the necessary cost data, the possibility arises of making a decision like the following:

Given the fact that it costs $A to teach one student in programme Y and $B to teach one student in programme Z, and given further the fact that the total dollars available are less than infinite, how many students should be taught programme Y, how many programme Z? At present, these decisions are not consciously decided, but are arrived at largely by happenstance.

Given the situation of a number of provincially-supported universities in competition for limited public funds, it seems reasonable to expect building and academic programme decisions to be made on somewhat more rational grounds than they are presently. If these decisions were made rationally by all universities, better utilization of tax monies might well result. The aggregate amount of monies expended might well not be less, but their sensible allocation as among various choices would be made more certain. In a world of scarce resources, allocation decisions are perforce made. The only question arising from the present discussion is how these decisions are made.

For the University of Guelph, a rational system of resource allocation can assure that resources are being expended such as to maximize the wishes of the faculty and administration and to minimize costs. Should other universities not follow the same procedures, the University would be at an obvious competitive advantage.

The system we envision is not a simple one, nor could it be implemented cheaply or quickly. The expected value of such an approach to university management is so large, however, that it is difficult to understand why such approaches are not commonplace. In addition to providing information and control for better administration, such a system could do much to lessen the very serious gulf between administrators and faculty members. For without such techniques the proliferation of administrators and the further fragmentation of their functions is inevitable in a large university.

UNIVERSITY OF GUELPH

FORM C - 2

FALL TERM 1964 INSTRUCTIONAL PR

(1)	(2)	(3)		(4)	(5)	(6)		(7)						(8)					
DEPARTMENT	COURSE NO.	SECTION TYPE		SECTION NO.	BUILDING NO.	ROOM NO.		DAYS AND PERIODS OF WEEK						NO. OF PERIODS PER DAY					
						BASIC	ALPH.	M	T	W	T	F	S	M	T	W	T	F	S
1 - 6	7 - 9	10 - 12	13-14	15-16	17 - 19	20-22	23-24	25 26	27 28	29 30	31 32	33 34	35 36	37 38	39 40	41 42	43 44	45 46	47 48
CHEM	101	LEC	23	01	243	100		10		10				10		10			
CHEM	101	REC	21	01	060	104						9						10	
CHEM	101	REC	21	02	259	206		11						10					
CHEM	101	REC	21	03	260	104						10						10	
CHEM	101	REC	21	04	260	104						11						10	
CHEM	101	LAB	31	01	243	107			9						25				
CHEM	101	LAB	31	02	243	107					9						25		
CHEM	523	LEC	23	01	243	104			16		16				15		15		

EXAMPLE 6.1

GUELPH UTILIZATION STUDY

TIONAL PROGRAM SPACE UTILIZATION

(8) NO. OF PERIODS PER DAY				(9)	(10)	(11)	
W	T	F	S	PERIODS P	NO. OF STUDENTS N	WEEKLY STUDENT PERIODS (CONTACT HOURS) NP	NOTES (NO PUNCH)
41 42	43 44	45 46	47 48	49 - 51	52 - 54	55 - 58	
1 0				1.0	1 0 0	2 0 0.0	
		1 0		1.0	2 5	2 5.0	
				1.0	2 5	2 5.0	
		1 0		1.0	2 5	2 5.0	
		1 0		1.0	2 5	2 5.0	
				2.5	5 0	1 2 5.0	
	2 5			2.5	5 0	1 2 5.0	
	1 5			3.0	1 2	3 6.0	

INSTRUCTIONAL PROGRAM PLANNING W

FORM C - 4

DEPARTMENT OF SUBJECT____
YEAR____________
TERM____________

(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)	(9)	(1
DEPARTMENT OR SUBJECT	COURSE NUMBER	COURSE TITLE (OR GENERAL DESIGNATION OF SUBJECT OF PROPOSED NEW COURSE)	SECTION TYPE		OPTIMUM NUMBER OF STUDENTS PER SECTION M	PERIODS P	SECTION MEETING PER WEEK T	YEAR ADDED OR DROPPED	ADDED=1, DROPPED=0	ACTUAL COURSE ENROLLMENT
			ALPHA	NUM.						
1 - 6	7 - 8	10 - 33	34-36	37-28	39-41	42-43	44	45-46	47	48-
CHEM	101	GENERAL CHEMISTRY	LEC	23	150	1.0	2			1
CHEM	101	GENERAL CHEMISTRY	REC	21	25	1.0	1			1
CHEM	101	GENERAL CHEMISTRY	LAB	31	50	2.5	1			1
						.				
CHEM	523	POLYMER CHEMISTRY	LEC	23		.		65	0	
						.				
CHEM	525	PROBLEMS IN PHYS CHEM	SEM	22	10	2.5	1	65	1	0

EXAMPLE 6.2

NNING WORKSHEET C-4

BJECT______________

SHEET Nº _____
OF __________
DATE _________

7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	
SECTION MEETING PER WEEK	YEAR ADDED OR DROPPED	ADDED=1, DROPPED=0	ACTUAL COURSE ENROLLMENT FALL 1964	PROJECTION FACTOR f1 1965-1964	ESTIMATED COURSE ENROLLMENT FALL 1965 E	PROJECTION FACTOR 1970-1964	PROJECTED COURSE ENROLLMENT FALL 1970	PROJECTION FACTOR f11 1975-1964	PROJECTED COURSE ENROLLMENT FALL 1975	REFERENCE NOTE Nº	BLANK	CARD TYPE	REMARKS (NO PUNCH
44	45 46	47	48-51	52-54	55-58	59-61	62-65	66-68	69-72	73-74	75-78	79-80	
2			100	1.50	150	.		.					
1			100	1.50	150	.		.					
1			100	1.50	150	.		.					
				.		.		.					
	65	0		.		.		.					
				.		.		.					
1	65	1	000	.	10	.		.					
				.		.		.					
				.		.		.					
				.		.		.					

FORM C - 3

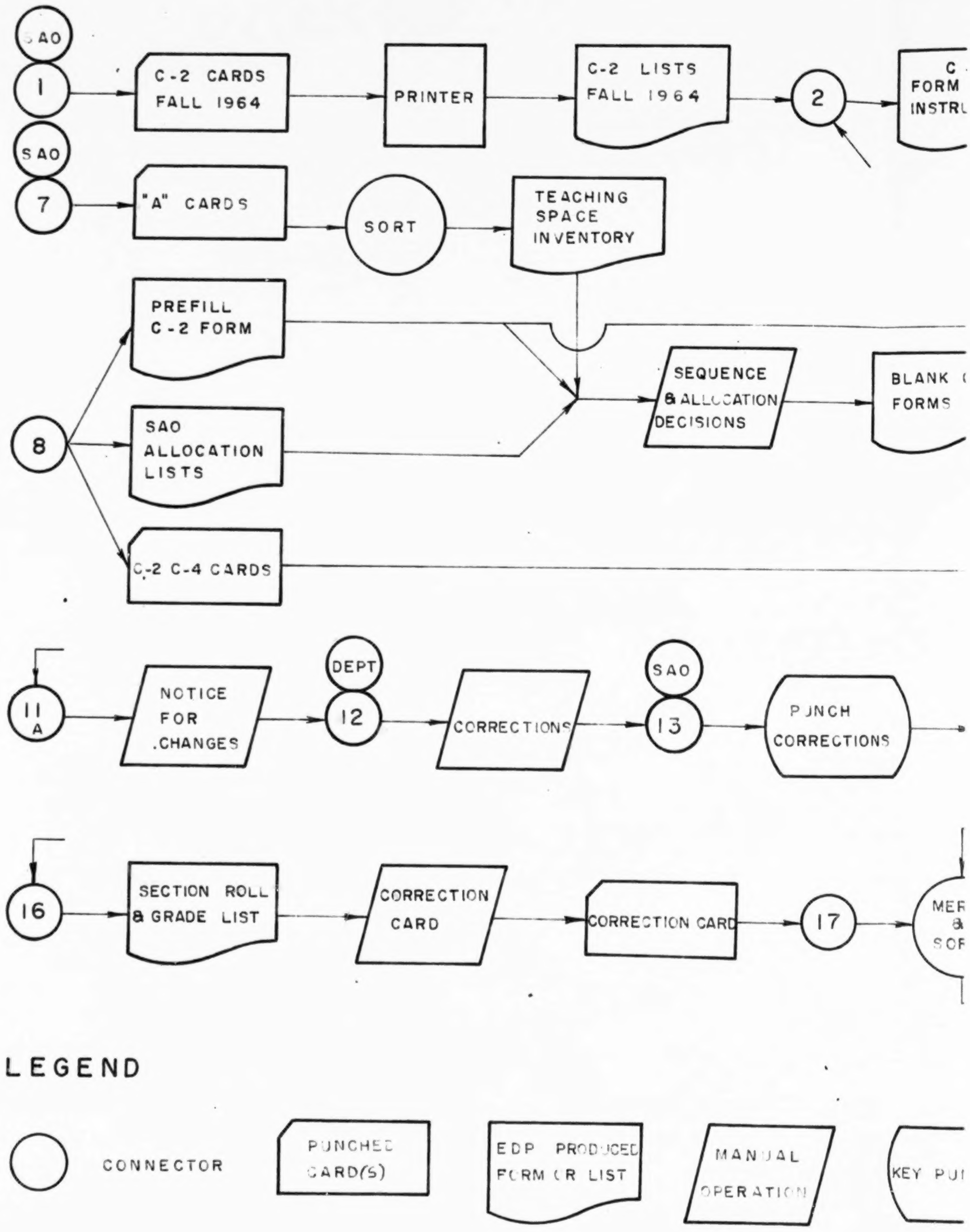
ROOM SCHEDULING WORKSHEET

TERM ______ YEAR ______

BUILDING _____________ ROOM NO. ______________

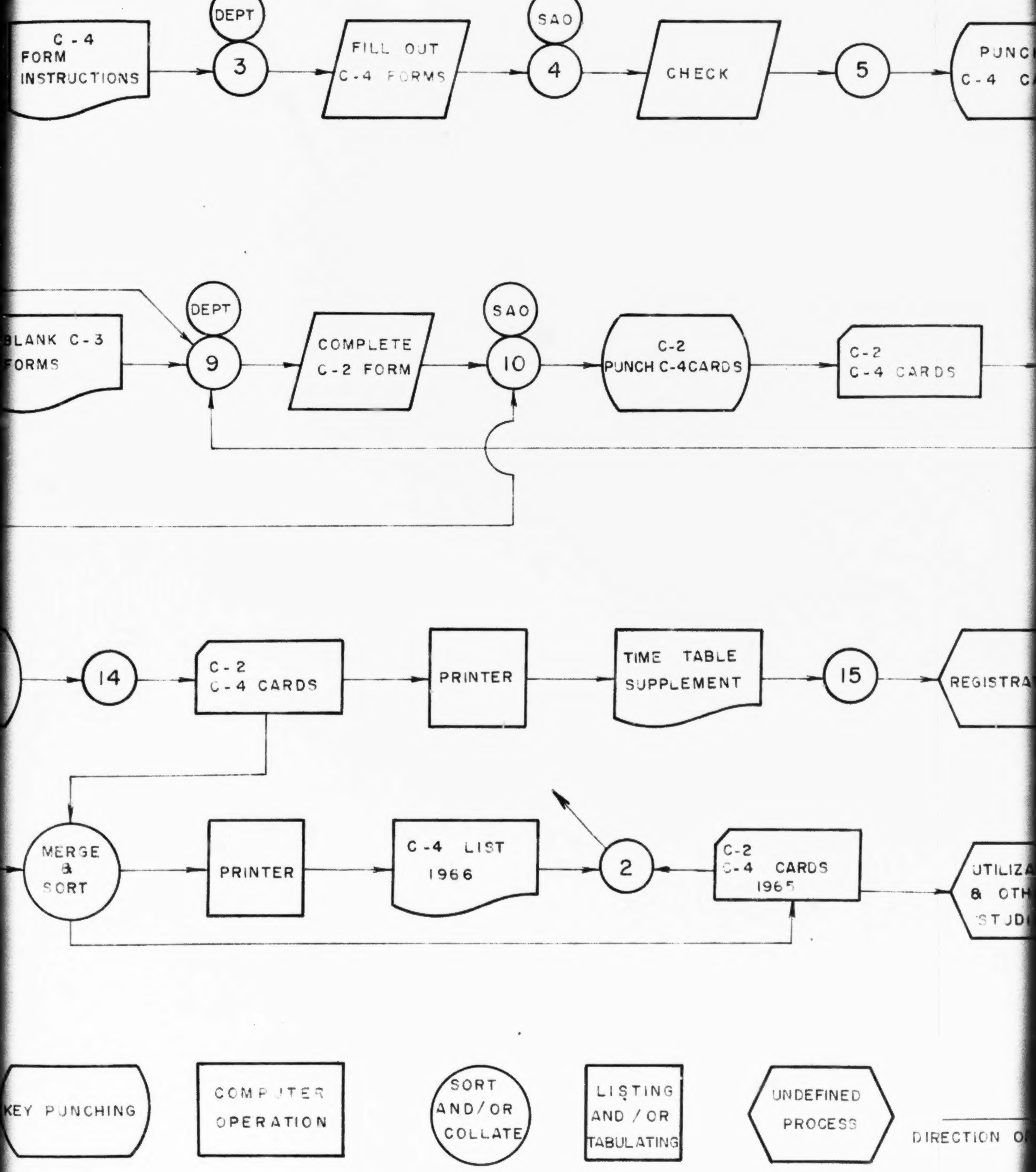
ROOM TYPE ____________ NO. OF STATIONS _________

PER.	START TIME	M	T	W	T	F	S
1	8:00						
2	9:00						
3	10:00						
4	11:00						
5	12:00						
6	1:00						
7	2:00						
8	3:00						
9	4:00						
10	5:00						
11	6:00						
12	7:00						
13	8:00						

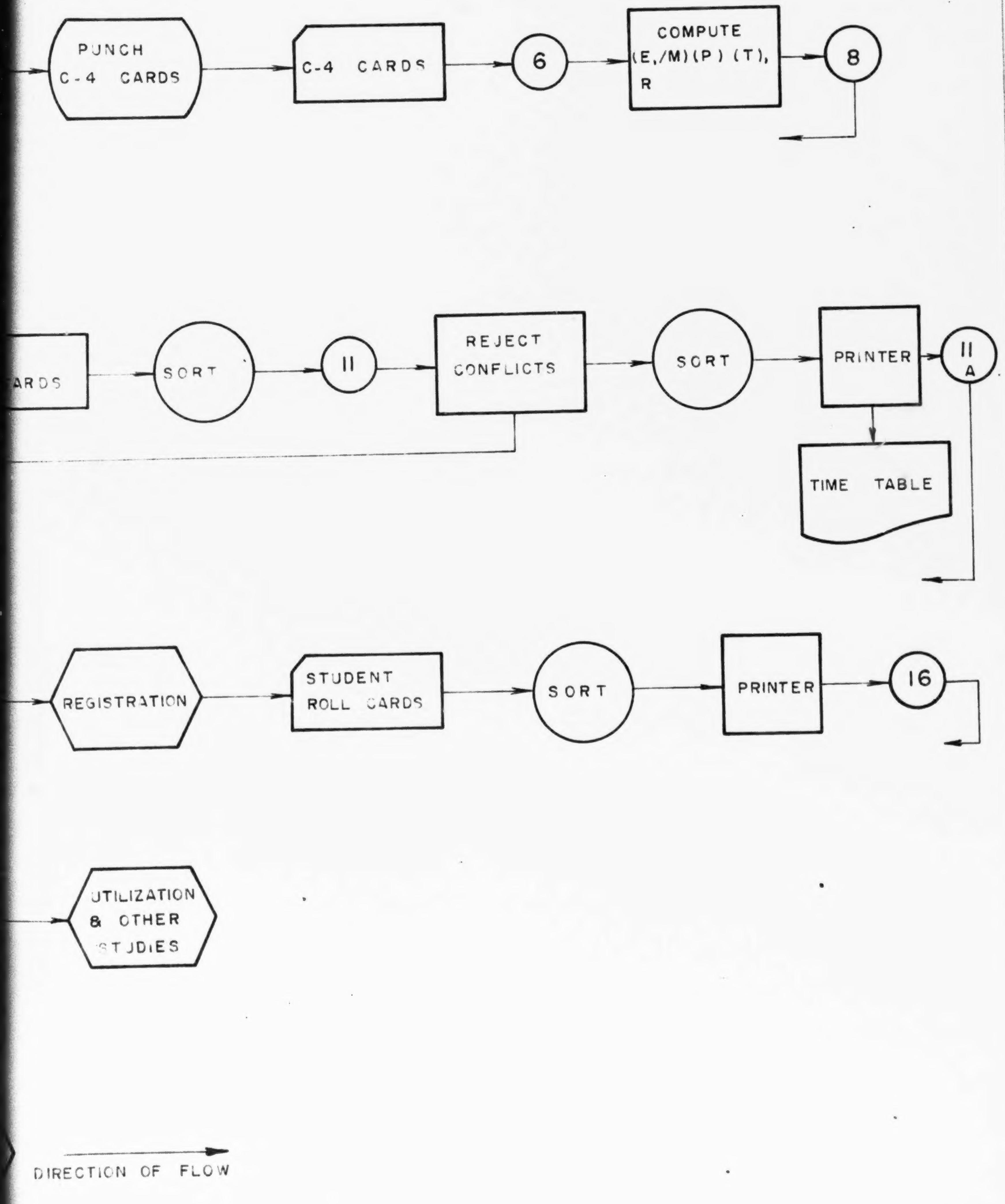


SAO
1
C-2 CARDS FALL 1964
PRINTER
C-2 LISTS FALL 1964
2
C
FORM
INSTRU
SAO
7
"A" CARDS
SORT
TEACHING SPACE INVENTORY
PREFILL C-2 FORM
8
SAO ALLOCATION LISTS
C-2 C-4 CARDS
SEQUENCE & ALLOCATION DECISIONS
BLANK
FORMS
11 A
NOTICE FOR CHANGES
DEPT
12
CORRECTIONS
SAO
13
PUNCH CORRECTIONS
16
SECTION ROLL & GRADE LIST
CORRECTION CARD
CORRECTION CARD
17
MER
&
SOR
LEGEND
CONNECTOR
PUNCHED CARD(S)
EDP PRODUCED FORM OR LIST
MANUAL OPERATION
KEY PU

FLO


C - 4
FORM
INSTRUCTIONS
DEPT
3
FILL OUT
C - 4 FORMS
SAO
4
CHECK
5
PUNCH
C - 4 C
BLANK C - 3
FORMS
DEPT
9
COMPLETE
C - 2 FORM
SAO
10
C-2
PUNCH C-4CARDS
C-2
C - 4 CARDS
14
C - 2
C - 4 CARDS
PRINTER
TIME TABLE
SUPPLEMENT
15
REGISTRA
MERGE
&
SORT
PRINTER
C - 4 LIST
1966
2
C-2
C-4 CARDS
1965
UTILIZA
& OTH
STUDI
KEY PUNCHING
COMPUTER
OPERATION
SORT
AND/OR
COLLATE
LISTING
AND / OR
TABULATING
UNDEFINED
PROCESS
DIRECTION O

FLOW DIAGRAM - SUGGESTED SYSTEM


PUNCH C-4 CARDS
C-4 CARDS
6
COMPUTE (E,/M) (P) (T), R
8
ARDS
SORT
11
REJECT CONFLICTS
SORT
PRINTER
11 A
TIME TABLE
REGISTRATION
STUDENT ROLL CARDS
SORT
PRINTER
16
UTILIZATION & OTHER STUDIES
DIRECTION OF FLOW

SECTION 7

ESTIMATED SCHEDULED INSTRUCTIONAL SPACE NEEDS TO 1970

7.1 Introduction

The requirements for instructional space -- classrooms, seminar rooms, teaching laboratories and studios -- are determined by the content, structure, and organization of the courses of instruction offered and the student loads enrolling in the various types of classes available.

In this study, the deans and heads of existing colleges and departments and the Dean of Wellington College made detailed and comprehensive projections of the instructional programme and student course enrolments to 1970, when the University expects to have 6,000 students. These projections, carried out on Form C-1 (see Working Documents) involved the determination of the specific kinds of courses to be offered; the probable structure of these courses in terms of types of section meetings, periods per week of scheduled section meetings, and the optimum number of students per section; and estimates of the total numbers of students expected to enrol in each course.

The compilations were keypunched and tabulated by computer to determine the total class section meetings of each type and size generated by each subject in 1970. These data can be used to schedule the instructional space requirements for each department up to 1970, following the general methodology outlined in detail in Section 6.

For estimating classrooms, seminar rooms, and lecture hall space, the number of weekly class section meeting periods projected for each type and size of facility are divided by the recommended average room utilization goal of 28 scheduled periods per week to determine the numbers of rooms of each type and size. An evaluation of the existing stock of classrooms was made, as outlined in Section 5, to determine which of these are likely to be continued in use in 1970. The difference between the total number of rooms required of each type and size and the existing stock to be continued in use through 1970 has provided the basis for determining the numbers, types, and sizes of new classrooms that must be constructed. Most of these are programmed into the new Arts building.

Special purpose instructional facilities, such as teaching laboratories and studios, are often limited in their use to the specific kinds of courses for which they are designed. Each type of special purpose facility must be analyzed specifically to determine need and scheduling capability. The data compiled in this study can be used to programme specific requirements with the following steps:

1. All courses that can use the same type of laboratory or studio facility should be grouped together. The total number of projected weekly laboratory section meetings for each type grouping indicates the scheduled

laboratory time that must be programmed.

2. Each grouping of courses using the same laboratory facility must be evaluated to determine its optimum scheduling capability. Average expected room utilization criteria are given in Table 3.6 to provide guidelines. Many laboratory groupings of highly specialized advanced courses will generate only a limited number of scheduled periods per week of use in 1970, but if these courses are to be offered at all they must be provided laboratory facilities.

Groupings with less than six weekly section periods, however, should be examined to see whether they cannot be assigned into other laboratory groupings. Large, multi-sectioned laboratory courses can be scheduled at much higher rates -- up to 36 periods per week.

3. Having determined the scheduling capability of each laboratory type, the number of room units required is determined by dividing the projected periods per week by the expected periods of utilization per week. Thus, if a general chemistry course generates, say, 40 laboratory sections meeting three periods per week each in laboratory for a total of 120 section periods per week, the general chemistry laboratories could be scheduled 30 periods per week. Four laboratory rooms would be required to handle this load.

4. The sizes of laboratory units are dictated by the desired numbers of students in each laboratory section. The number of student stations provided should

be slightly greater than the desired optimum number of students per section. The utilization criteria given in Table 3.6 calls for an average of 80 per cent station occupancy in laboratories. Hence, the desired section size, multiplied by approximately 1.25 will suggest an appropriate number of stations for each laboratory unit.

If, in the example given above, the general chemistry course were to be taught in laboratory sections of 20 students, laboratories might be designed with 25 stations. This permits slight increases in section sizes when enrolment exceeds expectation and avoid having to set up extra sections.

5. The floor area required for each laboratory unit is a function of the kinds of activity involved and the kinds of equipment and supplies needed in the laboratory or studio work. Generalized criteria of square feet per student station in typical kinds of laboratories are available when estimates of size are needed, but the final determination is worked out in the architectural layout of benches, equipment, and supporting facilities.

For general control purpose we have calculated below the net assignable square footage that would normally be generated by an enrolment of 6,000 full time students and faculty as indicated.

7.2 Calculations Of Space Needs To 1970 - Instructional And Related Space

1. Classrooms: The University department heads

projected 3,000 classroom-type periods per week by 1970.

Dividing this number by the recommended utilization standard of 28 periods per week, the resulting need is 107 classrooms of various sizes and types.

Average room size at Guelph is calculated to be 40 students per room, and this figure multiplied by 15 square feet per student station occupied gives the average room size, i.e. 600 assignable square feet.

Multiplying the average room size by number of rooms results in the total square feet of classroom space: 64,000 square feet rounded. Adding 10 per cent for auxiliary service space results in a classroom need of approximately 70,000 square feet rounded.

2. Teaching Laboratories: University department heads estimate 3,700 laboratory sections per week by 1970.

Divided by the 20 average periods per week (recommended utilization standard) the result is a laboratory need of approximately 185 rooms of various types.

Average number of student stations will be about 25, and the average student station about 45 assignable square feet. Multiplied, the result is an average room size of 1,125 assignable square feet.

Multiplying the average room size by number of laboratories (185 rooms by 1,125 square feet) gives a total space need of 208,000 square feet, rounded.

Adding 25% of the total for auxiliary space results in a net assignable square footage requirement of approximately 260,000 square feet for laboratories.

3. Research Generated by Faculty: These calculations are based on an assumed number of faculty engaged in research, and obviously are not as firm a figure as the previous calculations. Nonetheless, the calculations gives useful dimensions to the space programme.

Using the September 1964 faculty projection figures, the following distribution of faculty engaged in research requiring laboratory or similar space on campus has been assumed.

OAC - 150 out of 220 faculty at 1970
OVC - 50 out of 76 faculty at 1970
MI - 10 out of 25 faculty at 1970
WLC - 140 of 265 faculty at 1970

Total Faculty at 1970 - research space: 450

Multiplying 450 faculty by 120 square feet per faculty for research, results in space need of 54,000 square feet. Allowing 30% additional space for service, the total requirement would be approximately 70,000 square feet.

4. Research By Graduate Students: Using 1970 student projection figures supplied by the Deans of the academic units, the following numbers of graduate students would be generating research and clinical space.

OAC - 100 graduate students
OVC - 250 graduate students
MI - 10 graduate students
WLC - 35 graduate students

Total 395 graduate students.

Allowing 80 square feet per student, the resulting space need totals 32,000 square feet. Allowing for service space of 30%, the resulting need is 42,000 square feet rounded.

5. Faculty Offices: September 1964 faculty population projections have been re-examined on the basis of projected teaching hour loads. The University-wide faculty load (contact hours) is presently about six per faculty member. Typical university loads are about 12 per faculty member. The present situation reflects the specialized curriculum at Guelph, the large number of classroom hours for each student, and the research assignments which many faculty carry.

We expect the overall contact hour figure to rise by 1970 as the Arts curriculum is developed. Student to faculty ratios will rise from 1:5 to 1:15 approximately. Using normative faculty loads and the total projected teaching hours the resulting faculty population projection corresponds to the September estimates, so that figure is used below.

Multiplying number of faculty (581) by 120 square feet of office space per faculty gives a total office demand of 70,000 square feet rounded. Allowing 16% for service space generated by the offices, the rounded figure is 82,000 square feet.

6. Departmental Office Space: Fifty-six departments have been projected in the course enrolment offerings. Allowing 400 square feet per office the net result is

22,000 square feet rounded. Allowing secretarial help at the ratio of one per five faculty, the supporting secretarial service space is figured at 175 people multiplied by 100 square feet per person, or 17,500 square feet rounded. Adding 20% service space the assignable square footage figure is 21,000 square feet rounded.

7.3 Commentary

The probable size of instructional and related space needs to 1970 are thus calculated to be 567,000 square feet, (See Table 7.1, p. 98) or 98 square feet per student. This latter figure, if realized in the future, would place the university in a reasonable space utilization category.

The figures listed in Table 7.1 for classroom space (70,000 sq. ft.) are for control purposes only. For as shown in a previous section the University's present classroom stock is about 98,000 square feet. The control figures above are derived from optimum utilization standards and room sizes. The present stock tends to be oversized for the classes assigned to them. For example the average assignment rate is about 40%, so that the comparable figure of classroom space existing might be said to be about 45,000 square feet.

It should be noted immediately that not all the existing stock can be used in the future as some rooms are in obsolete buildings, others are located in parts of the campus where optimum utilization cannot occur because of distance between buildings, and of course oversized rooms cannot be filled if classes are not large enough to fill them.

The purpose of the above calculations are to demonstrate the very special care that must be taken in programming the design of new buildings.

The value of this control is already evident in the architectural programme for the first Arts building. The Arts building programme was begun towards the end of the space utilization study and has been thus affected by it.

The requirements, based on an analysis of the existing stock of various sized classrooms and the projected needs to 1970, were established on a preliminary basis to be as follows:

Number Of Rooms	Square Feet	Total Sq. Ft.
9	400	3,600
16	600	9,600
9	432	3,888
16	520	8,320
2	690	1,380
8	860	7,080
1	1,370	1,370
		35,238
Service Area		12,000
Total		47,238

The number of rooms above were determined on the basis of a utilization factor U=28. Present utilization at the University is approximately U=14. Thus, had the Arts I complex been programmed according to present standards the cost might have been an additional (47,000 square feet multiplied by $20.00 per square feet) $940,000.

Savings of this magnitude may be anticipated for future projects if this analysis is continued.

TABLE 7.1

Total projected net assignable square feet based on course offerings and estimated faculty and student population.

Classrooms	70,000 square feet
Teaching Laboratories	260,000 square feet
Faculty Research	70,000 square feet
Graduate Student Research	42,000 square feet
Faculty Offices	82,000 square feet
Departmental Offices	22,000 square feet
Departmental Secretarial	21,000 square feet
Total	567,000 Square Feet

APPENDIX -- SECTION 2

DERIVATION OF "NORMATIVE" (ABSTRACT)
BUILDING SPACE REQUIRED FOR 1800 FTE

		NORMATIVE	ACTUAL
1. Offices:			
400 Faculty & Professional @ 150 a.s.f. per staff		60,000	
300 Supporting Staff @ 100 a.s.f. per staff		30,000	
		90,000	116,000
2. Classrooms:			
890 periods per week ÷ 20 (standard) = 44 rooms; Avg. class size 40 Avg. room size 50 x 13 a.s.f. per sta = 650 a.s.f. per room x 44 =		28,600	98,000
3. Teaching Labs:			
624 periods per week ÷ 15 (Norm/rm.) = 21 rooms; Avg. class size 23 Avg. room size 28 50 a.s.f. per sta = 1400 a.s.f. per room x 21		29,400	75,000
4. Other Instructions:			
382 periods per week ÷ 10 (Norm) = 38 rooms Avg. class size 12 Avg. room size 18 18 x 50 a.s.f. = 900 per room x 38 =		34,000	48,000
5. Staff-Student Service:			
1800 Students x 10 a.s.f. =	18,000		
1000 Staff x 4 a.s.f. =	4,000	22,000	29,000
6. Research Labs:			
325 Faculty x 120 a.s.f. =	39,000		
75 Research x 120 a.s.f.=	9,000		
300 Grad & Advanced Vet. Students x 80 =	24,000		
	72,000		
Special Res. Facilities	30,000	102,000	147,000

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APPENDIX - SECTION 2 (CONTINUED)

			NORMATIVE	ACTUAL
7.	Library:			
	Need min. 250,000 volumes x 0.1 sf/vol. =	25,000		
	900 readers x 30 sf =	27,000		
	80 Fac. Studies x 60 =	4,800		
		56,800		
	Service 20%	11,360		
		68,160		
	Museum - As Is	14,360	82,520	43,000
8.	Physical Education:			
	1800 x 15 a.s.f.		27,000	51,000
	Athletic		24,000	
			51,000	
9.	Physical Plant & Auxiliary: Enterprises:			
	47.5 a.s.f. per 1000 sq. ft. plant 1,000 x 47.5 =		47,500	106,125
	Auxiliary enterprises as is		6,146	
			53,646	
10.	Residential & Food Service:			
	1000 x 200 a.s.f.		200,000	176,000
11.	Service Area:			
	Sum of Norm. = 693,000 a.s.f. allow 50% incr.		346,000	417,000
	TOTAL		1,039,000	1,250,000